RESEARCH REPORT

Eurofound

Employment and labour markets

IT sector in focus: Evolution of the EU's digital workforce

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Eurofound

European Foundation for the Improvement of Living and Working Conditions

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Executive summary

Introduction

Digital skills are becoming a transversal requirement in most occupations and sectors and a precondition of being able to work in nearly all faster-growing, knowledge-intensive sectors. In the vanguard of our digital transformation are those with advanced information technology (IT) skills and qualifications. These individuals develop software, manage network security, and research and develop new solutions in artificial intelligence (AI), quantum computing and other emerging technologies. The EU-27 is growing its ranks of such specialists but not at the required speed. Consequently, the contribution of IT activities to economic growth in the EU-27 has been underwhelming relative to that in other advanced economies. This report addresses the challenges for the digital workforce around employment and quality of work that need to be confronted if the EU-27 is to realise its ambitious digitalisation targets.

Policy context

Huge investment is being committed to the EU's digital transformation. There are generous EU and national subsidies available across an abundance of schemes and initiatives, especially in high-skill areas. Major initiatives at the EU level include the network of European digital innovation hubs, the Cybersecurity Skills Academy and the development of the EU's AI gigafactories. The Digital Decade policy programme 2030 has set the policy framework for these investments.

As regards the labour market, this programme has set the objective of having 20 million information and communications technology (ICT) specialists – a grouping covering several IT-related occupations – in employment in the EU by 2030. IT employment is growing fast, but this very ambitious target is unlikely to be met at current growth rates. Mobilising extra sources of supply of digital talent is therefore becoming more urgent. This is reinforced by changing technological and geopolitical circumstances, notably the expanding possibilities of AI, increasing cybersecurity threats and the importance of the EU developing its digital independence and 'sovereignty'.

The skill demands associated with these challenges are skewed to higher-level qualifications. Gaining these skills requires many years of post-school academic training supplemented by further education and on-the-job learning. The pipeline of these skills is constrained. The number of young people electing to study science, technology, engineering and mathematics, while increasing, is still not enough, and some of those who do pursue such studies are drawn by higher pay in other sectors or other countries. Women remain under-represented in the ICT sector. By most accounts, the growth in demand for the IT workforce, combined with rapid technological change, is outpacing the ability of our education systems to equip sufficient individuals with the required skills.

Key findings

- IT employment is growing fast in the EU (with an annual growth rate of 7–8 % compared with an overall employment growth rate of just over 1 %), but from a modest base. ICT specialists accounted for 3 % of EU-27 employment in 2011 and 5 % in 2024. There are very wide differentials in the share of ICT specialists in total employment across EU Member States – ranging from 2.5 % in Greece to 8.6 % in Sweden.
- Growing demand means widespread shortages of ICT specialists. In 2024, among firms with open IT vacancies, 57 % reported difficulties in filling the positions. Labour shortages are especially acute for senior roles and highly specialised roles in cybersecurity, AI / generative AI and cloud computing.
- Education and vocational education and training systems are failing to meet current and projected employment demand in most Member States, according to EU-level employer surveys and national correspondent inputs.
- Labour migration from non-EU countries has become a primary, and increasingly important, driver for satisfying the high employer demand for ICT specialists in the EU, outpacing the contribution from intra-EU labour mobility.
- Quality of work and employment in IT is higher than average across nearly all dimensions, notably earnings and skills, according to European Working Conditions Survey (EWCS) data.
- Wide gender gaps in IT employment are persistent and are closing at a slow pace. Fewer than one in five (19 %) ICT specialists in the EU-27 were women in 2024. Gender pay gaps in the broader information and communication sector were just below 20 % in 2022, compared with 13 % for the workforce in general.

- Sharp divergences by gender are also observed across different job quality dimensions. Female ICT specialists are much less likely to consider themselves fairly paid for their work, have less access to paid training, are exposed to higher levels of work intensity and adverse social behaviours, and have less influence over how their work is organised. Outcomes like these may be discouraging women from entering the field.

Policy pointers

- The Digital Decade employment target of 20 million ICT specialists by 2030 is unlikely to be met. At the current rate of growth, the EU will fall short by some 5 million workers.
- The explanation for labour and skills shortages in IT is on the supply side (that is, education, including further and postgraduate education, and training, including on-the-job training) and not related to working or employment conditions. According to EWCS data, ICT specialists in the EU report better-than-average job and employment quality across all dimensions, but especially pay and skills.
- Restrictive immigration policy elsewhere is likely to have made Europe a more attractive location for experts from non-EU countries, including in ICT specialisations with high global demand. There is suggestive evidence that this may already be happening. At the same time, limited intra-EU mobility of ICT specialists shows that there is a potential to mobilise existing EU tools such as EURopean Employment Services (EURES) and Erasmus+ to meet skills shortages.
- Closing the gender employment gap in IT is not only a matter of equity but also a matter of economic necessity. In a context of labour shortages, failing to attract women means that the EU is operating with less than three quarters of its potential talent pool of ICT specialists. It is also limiting the diversity of perspectives in shaping technologies that increasingly influence all aspects of society, in and outside work.

Introduction

Digital skills are becoming a transversal requirement in most occupations and sectors and are a precondition of being able to work in nearly all faster-growing, knowledge-intensive sectors. Indeed, the growth in employment in many of these sectors is due to efficiencies gained through digital technologies: instant communication locally and globally, standardised data formats and task automation.

Beyond literacy and basic levels of competence, however, there is additional pressure to increase the share of those with advanced skills and qualifications in information technology (IT). These are the individuals who design computer hardware, write code for software and create or maintain workplace computer networks and online platforms. The share of employment devoted to such tasks is increasing much faster than the size of the workforce more generally. This reflects intensifying demand across sectors. At present, this workforce equates to just 1 in 20 workers; the EU target is that by 2030 around 1 in 10 workers will be information and communications technology (ICT) specialists – a specific group of detailed IT occupations defined by the statistical office of the European Union (Eurostat) and the Organisation for Economic Co-operation and Development (OECD) ([1]).

At the start of the decade, the COVID-19 pandemic globally accelerated digitalisation in many sectors that had hitherto been comparatively sheltered from the digital transition. One so far persistent legacy of the pandemic has been a doubling of the share of work carried out remotely in developed countries. Other external factors that have driven the increased demand for IT workers are:

- the rapid rise of generative artificial intelligence (AI) / large language models since the launch of ChatGPT 3.2 in 2022 and the related exponential growth in cloud computing capacity and data centres;
- increasing cybersecurity threats, notably alongside the rise of bad actors (including state-supported ones) amid increasing geopolitical tensions;
- a renewed focus on the EU's digital 'autonomy' or 'sovereignty' given its over-reliance on IT services owned and controlled elsewhere.

The IT sector encompasses a high-skilled, productive and fast-growing set of activities. The Draghi report on European competitiveness (Draghi, 2024), however, underlined how the EU's comparatively weak IT performance has significantly limited aggregate EU-level productivity for a generation. IT could and should be contributing more.

In this report, the authors address IT employment challenges, notably labour and skills shortages, which may be impeding faster growth in line with EU policy targets, and assess the extent to which working and employment conditions for specific categories of workers, notably female ICT specialists, may be holding back their contribution.

The report is organised as follows. Chapter 1 uses mainly EU Labour Force Survey (EU-LFS) data to highlight the pace of employment growth in the IT workforce, variously defined across EU Member States and for various demographic categories. Chapter 1 also addresses labour shortages in IT as a result of high demand for workers with IT-related skills, the evidence on which is summarised based on contributions from the Network of Eurofound Correspondents.

Chapter 2 utilises European Working Conditions Survey (EWCS) data to assess job quality dimensions for ICT specialists not covered in the EU-LFS – notably the use and impact of digital technologies at work, including generative AI use, task content and access to training. This chapter also identifies gender gaps in the information and communication sector, especially with regard to quality of work, explaining why careers in IT may be of limited appeal to women.

Chapter 3 addresses three dimensions of change in IT employment:

- recent restructuring activity in the sector, where bouts of rapid business expansion have alternated with hiring freezes and layoffs;
- the career transitions of workers within and beyond the IT industry;
- the development of specialised IT clusters intended to accelerate commercial application of new technologies, with these clusters tending to concentrate in larger metropolitan areas.

Chapter 4 gives an overview of recent developments in social dialogue in a sector that has been characterised by low levels of union representation and limited collective bargaining coverage.

([1]) As there are several contending taxonomies of what constitutes an 'IT worker' or the 'ICT sector' (see Annex 1), this report uses a dual occupational and sectoral focus, depending on data availability. Hence, both 'IT' and 'ICT' are used throughout this report, depending on the specific area discussed or the source used.

Chapter 5 summarises the main findings of the report and offers relevant policy pointers.

Policy context

The EU has an ambitious digital transformation agenda. The overall framework for European digital policy is set by the Digital Decade policy programme 2030, adopted in December 2022. Under the programme, the digital skills pillar aims for (1) at least 80 % of the European population aged 16–74 to have at least basic digital competence by 2030 and (2) 20 million ICT specialists to be employed across the EU by 2030. It also focuses on increasing female participation to address the gender imbalance in the sector, with fewer than one in five ICT specialists currently being women.

Progress towards these aims has been slow to date. According to the 2025 report on the state of the Digital Decade, there is little chance of the ICT specialist employment target being met. The projected shortfall underlines the scale of action required across education systems, both academic and vocational/further education, to generate a stronger pipeline of qualified IT workers. The EU has devoted substantial financial resources to supporting digital skills development across Member States, with the Recovery and Resilience Facility (RRF) as the largest single funding source. An estimated EUR 23 billion from the RRF (just over 18 % of its total resources) targets digital skills development across all proficiency levels. In addition to the RRF, the digital Europe programme supports advanced digital skills training in AI, cybersecurity, high-performance computing and related areas, with a budget of nearly EUR 0.5 billion over 2021–2027. Related initiatives include the European digital innovation hubs, the Cybersecurity Skills Academy and the Digital Skills and Jobs Platform. In addition, Member States have outlined digital transformation measures with a total value of EUR 288.6 billion in their national recovery plans.

Nevertheless, this commitment and generous allocation of resources to digitalisation come in the context of Europe's comparatively underwhelming IT performance in recent decades. As highlighted in the Draghi report on European competitiveness (Draghi, 2024), no EU company founded in the last 50 years has reached a market capitalisation of more than EUR 100 billion, while six US companies – all in the IT sector – founded in the same period are all now valued at more than EUR 1 trillion. Investment in research and development (R&D) in Europe is still disproportionately focused on mature sectors such as the automotive industry, while elsewhere the balance has shifted to digital technologies. The competitiveness compass (presented in 2025) is the European Commission's positive response to Draghi's critical assessment and commits to large-scale IT projects, including a fund to develop four AI gigafactories.

Many policy levers are in place to give a renewed impetus to Europe's digital transformation, but much work needs to be done.

Objectives

The main objective of this report is to provide an evidence-based analysis of the employment trends and quality of work of the digital specialist workforce in the EU-27.

Specific goals are:

- to examine the prevalence of labour bottlenecks for IT workers in a context of rapid employment growth and high exposure to technological change in IT-related activities;
- to provide new evidence on how technologies – including generative AI – may be impacting employment and workplace tasks among IT workers;
- to describe gaps and inequalities evident in the EU's IT labour market, including the numerical imbalance between male and female workers and the disparity in quality of work between male and female IT specialists.

From a policy perspective, the authors hope that the report will provide insights for the ongoing review of the Digital Decade 2030 framework so that EU and national digitalisation investments – under the RRF, for example – are aligned with the work organisation and skills needs of the IT workforce and employers. This is a necessary condition for the EU to address its shortcomings in translating the potential productivity gains from digitalisation into actual gains.

Methodology

This report uses a combination of quantitative and qualitative inputs.

On the quantitative side, the report relies on the main relevant EU-wide data sources to describe employment trends and developments in quality of work for IT workers across the EU-27. The two principal sources are the EU-LFS and Eurofound's own EWCS.

As there are several contending taxonomies of what constitutes an 'IT worker' or the 'ICT sector' (see Annex 1), the authors have decided to use a dual occupational and sectoral focus. The definition of an ICT specialist – developed by the OECD and used by Eurostat, based on detailed occupational categories – allows us to identify workers with IT skill sets more precisely, regardless of the sector in which they work. The same categorisation of IT occupations informs the relevant EU-level policy target: the Digital Decade 2030 objective that the EU-27 should have 20 million ICT specialists by 2030.

The population of ICT specialists is monitored using detailed occupational data that are captured in both the EU-LFS and the EWCS (see Annex 1 for a detailed taxonomy). Sector-level detail is invariably less granular in the main available data sources. For several reasons – data limitations impeding a purely sectoral approach, granular data availability at the occupational level and policy relevance – we use the 'ICT specialist' occupational category as our unit of analysis, where data allow. This is the case for most of the findings in Chapters 1 and 2. Where this is not possible, we use either the broader occupational categories, notably 'ICT professional' (International Standard Classification of Occupations (ISCO) 25), or relevant sectoral categories, notably 'information and communication' (NACE (general industrial classification of economic activities within the European Union) Section J) and 'computer programming, consultancy and related activities' (NACE Division 62). In practice, there is significant overlap between these categories and, for most outcomes, trends are similar, with only modest differences in estimates.

Other survey sources used in the analysis include the Structure of Earnings Survey (SES) and the Survey on ICT Usage and E-Commerce in Enterprises (ISOC_E).

Additional quantitative data come from Eurofound's European Restructuring Monitor (ERM) events database, which tracks large-scale restructuring events. LinkedIn hiring rate and career transition data, provided by LinkedIn's Economic Graph research team, are also used.

On the qualitative side, the report benefits from questionnaire-based contributions from the Network of Eurofound Correspondents under three themes: addressing labour shortages, IT clusters and recent developments in social dialogue in the IT sector (see Annex 3). The questionnaires were completed from September to October 2025 and summaries of the national contributions are incorporated in the report. A summary of a relevant national exercise on IT skills forecasting is also included (see Box 4).

Official labour market data sources often rely on outdated occupational classifications, making it difficult to identify new and fast-growth jobs in the IT domain. These jobs – specifically cybersecurity and AI specialists – were the focus of a series of workshops on IT skills needs organised by Ireland's Expert Group on Future Skills Needs in late 2025, in which the authors participated. This event showed how Ireland, one of the smaller Member States, with a dynamic and fast-growing IT base, is positioning itself to sustain this growth by strengthening its labour and skills pipelines.

1 Recent employment trends in IT

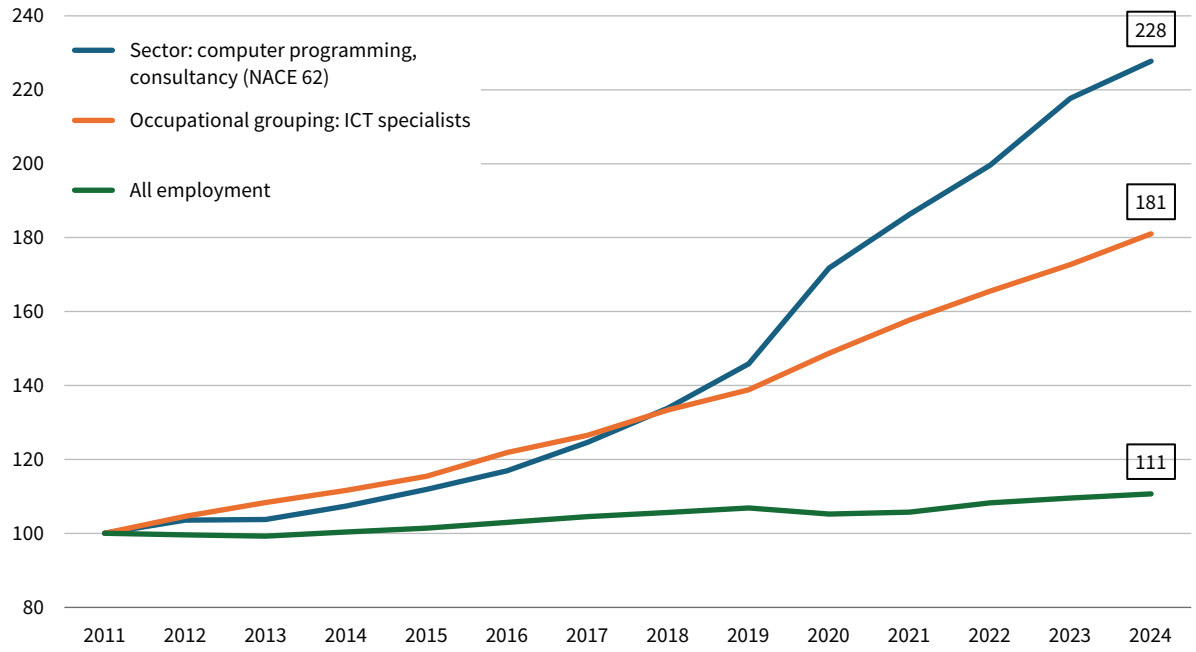
Between 2011 and 2024, the European labour market underwent a structural shift towards digitalisation. While total employment in the EU-27 saw a steady but modest recovery and growth following the global financial crisis, the core IT sector (NACE 62: computer programming, consultancy and related activities) and the broader occupational category of ICT specialists experienced much faster expansion. According to the joint Eurostat and OECD definition, ICT specialists are defined as workers 'who have the ability to develop, operate and maintain ICT systems' and for whom ICT constitutes 'the main part of their job' (see Annex 1).

By 2024, there were 10.3 million ICT specialists in the EU, an 81 % increase compared with the 2011 baseline (5.6 million), as indicated by the index in Figure 1. Employment in the core IT sector (NACE 62) recorded even faster growth, with the workforce more than doubling, from 2.2 million in 2011 to 5 million in 2024 – a 128 % increase. This highlights the intensifying demand for specialised external IT consultancy and software development services across all sectors of the economy.

By contrast, total employment across all sectors grew by around 11 % over the same 13-year period. The data reveal a widening gap. IT sector employment is growing at eight times the compound annual growth rate of that of the economy as a whole. Of note, the index shows a steepening of the curve following 2020. This is likely to have been driven by the accelerated digital transformation triggered by the COVID-19 pandemic and the subsequent surge in demand for digitalisation solutions, including cloud infrastructure, cybersecurity and, more recently, AI-related roles. As we suggest later, one plausible explanation of the divergence between sectoral and occupational measures of IT employment after 2020 is the outsourcing of IT functions from non-IT firms to specialised IT firms.

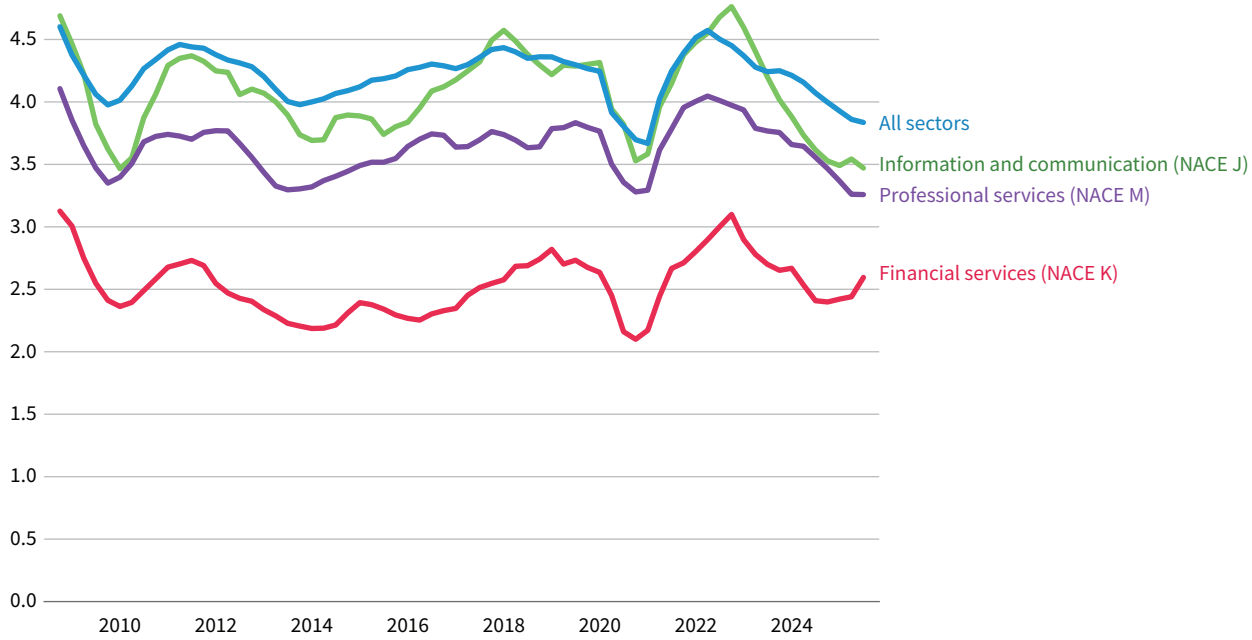
Although the sector is experiencing strong structural growth, the hiring of ICT specialists has become somewhat volatile and selective, which is also evident in LinkedIn data and ERM restructuring data, discussed in the next section. Figure 2 tracks the share of employment accounted for by new recruits – those with a job tenure of less than three months – based on recent EU-LFS quarterly data, for selected NACE one-digit sectors. We can see a downward trend at the time of the initial COVID-19 wave in 2020, followed by a sharp rebound peaking in the last quarter of 2022 and an equally sharp decline thereafter to 2024. The share of new recruits who are ICT specialists has tended to be higher than the share of new recruits in other knowledge-intensive sectors (professional, scientific and technical activities and financial services), most probably reflecting high job turnover and frequent job-to-job moves. The trend has also been more volatile in the ICT sector, with evidence of aggressive hiring and labour hoarding in the aftermath of the COVID-19

Figure 1: Recent employment growth in IT, EU-27 (2011 = 100)



Source: EU-LFS data (authors' elaboration).

Figure 2: Share of employment of new recruits with less than three months' tenure (proxy for recruitment rate), by selected sector, EU-27, 2008 to the third quarter of 2025 (%)



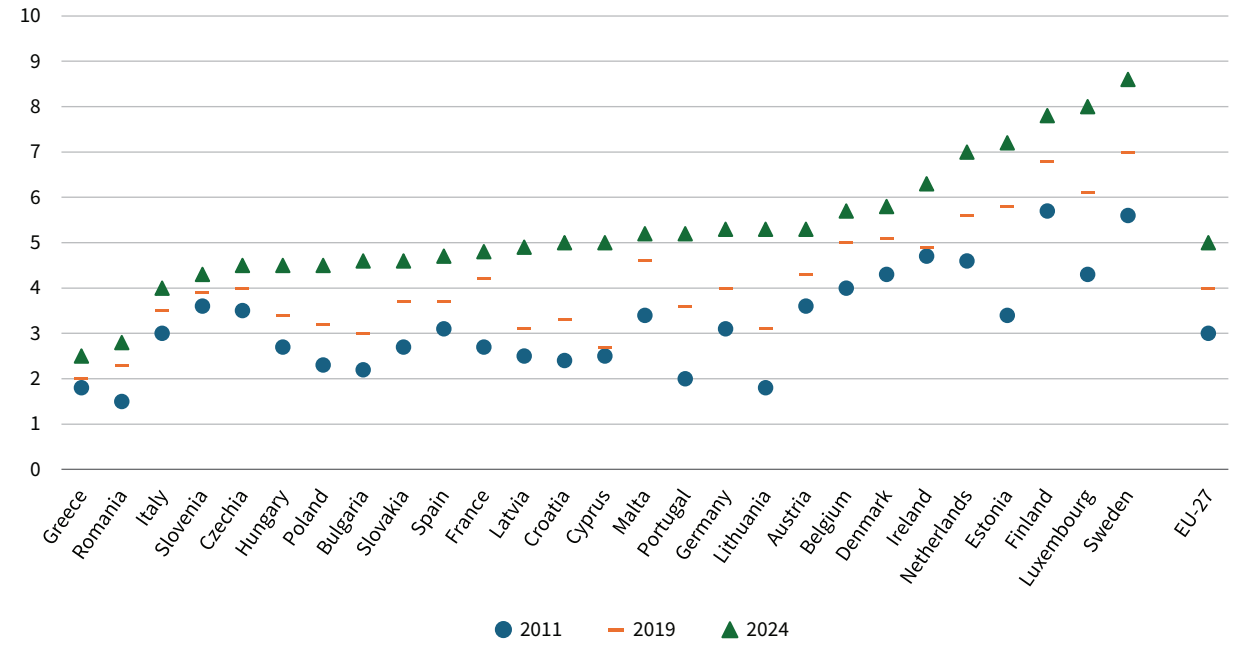
Note: Four-quarter moving averages.
Source: EU-LFS quarterly data, ad hoc extraction.

pandemic. The most recent data, for the first three quarters of 2025, show some stabilisation but at lower rates of recruitment. In 2025, around 3.5 % of those employed as ICT specialists were new recruits, comparable to the shares observed during the global financial crisis and the initial COVID-19 lockdowns.

Nonetheless, recruitment in 2025 remained higher in absolute terms than in any period prior to 2020.

The share of ICT specialists in the EU-27 workforce has grown consistently, rising from 3 % in 2011 to 4 % in 2019 and reaching 5 % by 2024 (see Figure 3). While the upward trend is universal, wide variation is observed

Figure 3: ICT specialist share of total employment, by Member State, 2011–2024 (%)



Source: EU-LFS data (authors' elaboration).

between Member States. If we regard the share of ICT specialist employment as a proxy for the pace of digitalisation, a group of Nordic and Benelux countries (Belgium, Finland, Germany, Luxembourg, the Netherlands and Sweden) continue to lead the transition, as do Estonia, Denmark and Ireland. In 2024, Sweden (8.6 %), Luxembourg (8.0 %) and Finland (7.8 %) boasted the highest concentrations of ICT specialists. These Member States had already surpassed the 2024 EU average by 2011, indicating a long-term structural advantage in IT employment. Some Member States have seen dramatic shifts; for example, Estonia more than doubled its share from 3.4 % in 2011 to 7.2 % in 2024, moving from a mid-tier position to a near-top position. Very strong growth was also recorded in Lithuania and Portugal, with both Member States moving from low positions to mid-ranking positions over the period.

Despite growth in every Member State, a significant gap remains. In 2024, Greece (2.5 %) and Romania (2.8 %) had employment shares that the leading Member States had already exceeded well before 2011. In Greece, in particular, the ICT employment share grew only marginally.

While ICT specialist employment in the EU has reached a positive milestone of a 5 % share of total employment, current projections suggest that the EU is still unlikely to meet its ambitious 2030 target of 20 million ICT specialists. A simple extrapolation based on average growth recorded over 2011–2024 (with a compound annual growth rate of 6.5 %) would leave the EU around 5 million ICT specialists short of its target. To reach the target would require increasing the compound rate of annual employment growth to 11.8 %. This would require the EU-27 as a whole to enjoy, over the remainder of the decade, a compound annual growth rate surpassing that of the Member State with the fastest rate of ICT specialist employment growth over 2011–2024 (Portugal, 9.8 %).

Table 1 lists the specific occupations that accounted for most ICT specialist workforce employment in 2024 and shows the occupations that experienced the fastest growth between 2021 and 2024. The ICT specialist workforce spans a wide range of roles, from strategic management to technical support. In 2024, the workforce was dominated by software developers and systems analysts, who together accounted for nearly 30 % of all ICT specialists. The data highlight a clear trend of internal upgrading: employment in higher-skilled occupations in development and analysis roles is growing fastest, while employment in traditional support roles and design roles (such as multimedia designers) is growing at a more conservative pace.

Software developers represent the largest single defined occupational group, with 1.7 million workers across the EU. This group grew by 26.5 % between 2021 and 2024 – nearly double the average growth recorded for all ICT specialists (14.2 %) during the same period. The fastest-growing occupation is software and applications developers/analysts (not elsewhere classified), which grew by 43.7 % in just three years. This may reflect the emergence of new, specialised roles in AI, cloud architecture and data science that are not easily identified in the current version of ISCO.

Table 1: ICT specialist workforce, by detailed occupation, EU-27

ISCO	Occupation	Employment in 2024 (thousands)	% change in employment, 2021–2024
2512	Software developers	1 699	27
2511	Systems analysts	1 295	17
3512	ICT user support technicians	805	10
2166	Graphic and multimedia designers	674	2
2514	Application programmers	609	27
2522	Systems administrators	492	15
3511	ICT operations technicians	462	10
2519	Software and applications developers/analysts NEC	404	44
2152	Electronic engineers	385	26
1330	ICT service managers	377	14
	Other ICT specialist occupations	2 973	5
	Total ICT specialists (EU-27)	10 176	14

Note: Includes only the top 10 four-digit occupations by employment. Data at this level of occupational detail are only available in the EU-LFS from 2021. Total value of 10 176 is a result of rounding; all individual values are correct. NEC, not elsewhere classified.
Source: EU-LFS data, ad hoc extraction (authors' elaboration).

Application programmers (+ 26.9 %) and electronic engineers (+ 26.4 %) also outperformed the sector average.

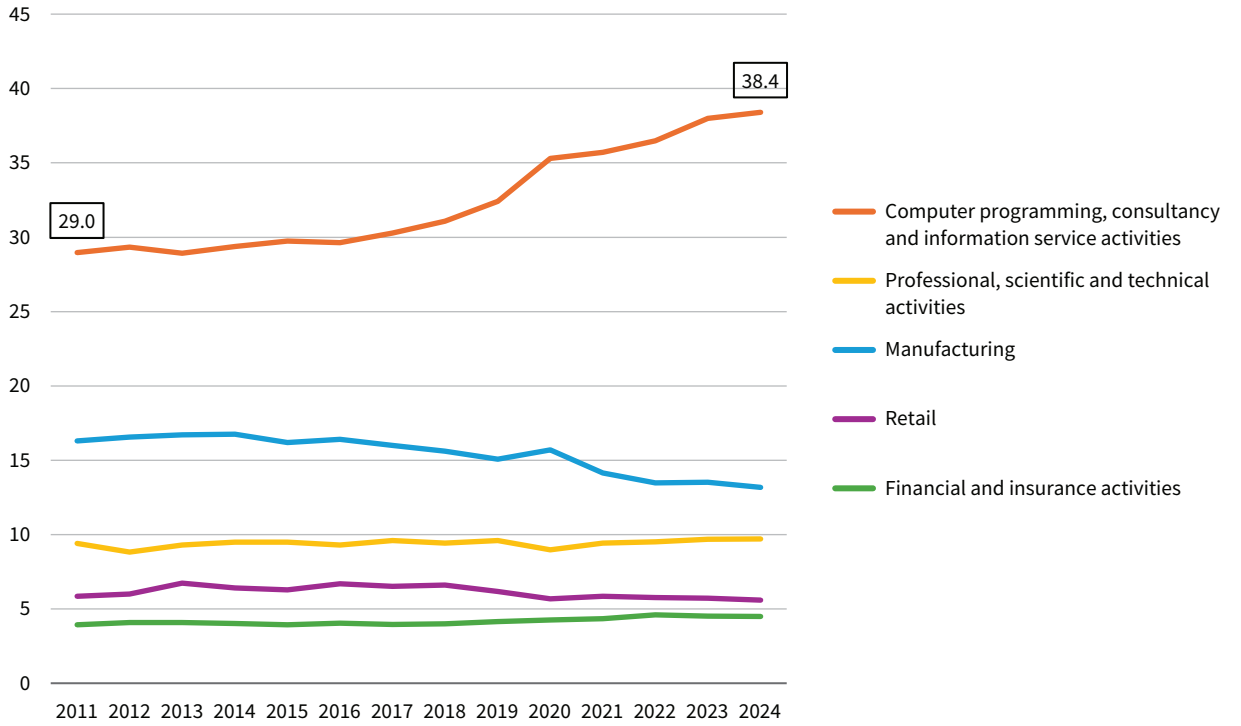
While professional-level development and analyst roles are growing fastest, associate-professional-level occupations are growing more slowly. ICT user support technicians are an important pillar of the IT workforce, with more than 800 000 workers. Relatively modest employment growth for this occupation and that of ICT operations technicians (10 %) is suggestive of automation of at least some of the more routine tasks in these occupations. The category with the slowest rate of growth, graphic and multimedia designers (+ 2 %), is also one with high AI exposure. The increasingly powerful image creation and editing possibilities of generative AI are probably contributing to a slowdown in employment growth here.

The sectoral distribution of ICT specialists reveals a trend towards functional specialisation. While ICT roles are expanding in every sector of the economy in absolute terms, a higher share is increasingly concentrated within the core ICT sectors (NACE 62 and 63). In 2024, around 4 in 10 ICT specialists (38.4 %) worked for specialised IT services, while sectors such as manufacturing and retail are seeing their relative share of the total ICT specialist workforce decline (see Figure 4).

The share of ICT specialists employed in computer programming, consultancy and information services (NACE 62 and 63 combined) grew from 29 % in 2011 to 38.4 % in 2024. Meanwhile, the share employed in manufacturing, in particular, has declined – from 16.3 % to 13.2 % – as has the share employed in retail, although even in these two sectors the absolute numbers of ICT specialists are increasing.

Plausible drivers of the increasing concentration of IT specialist employment within the IT sector include an increasing recourse to outsourcing among non-IT sector firms. Instead of maintaining large, expensive in-house IT departments, many firms may prefer to buy specialised services from consultancy or IT firms. The shift from on-premises software to software as a service and cloud platforms means that the builders and maintainers of the software are now employed by the service providers rather than by end-user companies. The increasing specialisation of IT functions probably reinforces outsourcing trends. As IT roles become more complex (involving, for example, DevOps, AI / machine learning and data engineering), it is often easier for a specialised tech company to recruit and retain such profiles than it is for a traditional manufacturer or retailer. This can also facilitate companies' access to cutting-edge expertise in fields such as AI or cybersecurity.

Figure 4: Distribution of ICT specialist employment, by sector, EU-27, 2011–2024 (%)



Note: Selected sectors only.
Source: EU-LFS data, ad hoc extraction.

In retail, the shift towards a few large e-commerce platforms (such as Shopify) means that IT needs are consolidated within those few entities (often classified in NACE 62 and 63) rather than distributed across thousands of individual retail firms. In manufacturing, while smart factories require high-level ICT skills, the focus is often on specialised systems that are serviced by external technology partners rather than a permanent in-house IT workforce.

Demographic characteristics

Age

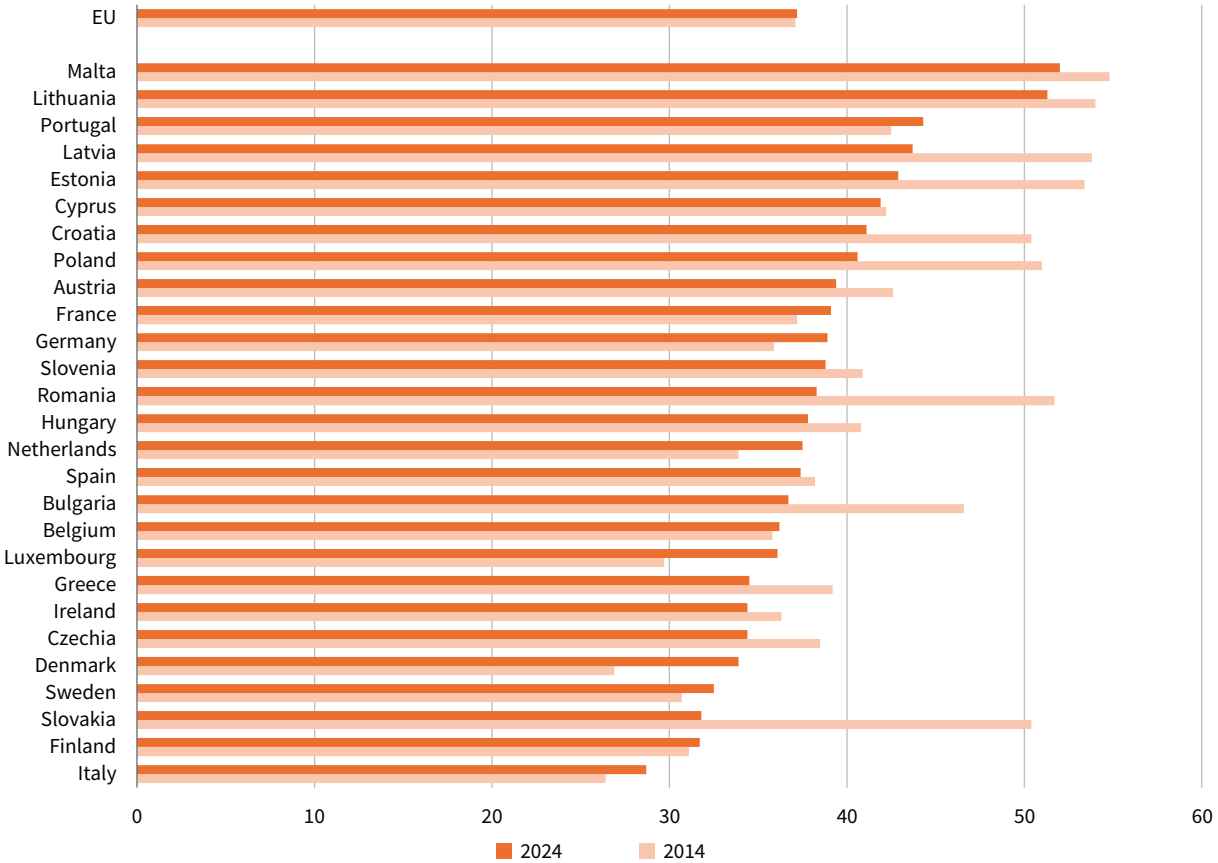
The share of workers aged 35 and under can be seen as a proxy for a healthy pipeline of future senior managers and professionals in the sector. This share has remained stable at the aggregate EU-27 level (Figure 5), at around 37 %. However, this stability masks significantly contrasting national trends. The data suggest that the pipeline of future talent is under pressure in regions that previously had the youngest tech specialist workforce, while western European tech hubs are either attracting or producing more young ICT specialists.

The most striking trend is the sharp decline in the share of young ICT specialists in central and eastern European (CEE) Member States. In 2014, Member States like Poland (51 %), Romania (51.7 %) and Slovakia (50.4 %) had ICT specialist workforces where more than half were aged under 35. By 2024, these shares had declined, most notably in Slovakia (– 18.6 percentage points (pp)) and Romania (– 13.4 pp).

In contrast, several western European nations have seen an increase in their share of young ICT specialists. The share of younger ICT specialists has grown in Denmark (+ 7 pp), Luxembourg (+ 6.4 pp) and the Netherlands (+ 3.6 pp), probably owing to successful international recruitment – migrant and mobile labour in the sector is disproportionately under 35 years of age – and the expansion of domestic computer science programmes.

Lithuania (51.3 %) and Malta (52 %) remain the only Member States where more than half the ICT workforce is under 35. Malta's high share of young ICT workers is most probably driven by its non-native employment. Italy (28.7 %) and Finland (31.7 %) continue to have the lowest proportions of young ICT specialists, which may present a potential long-term risk for skills replacement and innovation capacity. Europe's largest technology labour markets are showing resilience in their ICT specialist age profiles. Germany saw its share of workers aged 35 and under rise from 35.9 % to 38.9 %, while in France the share increased from 37.2 % to 39.1 %.

Figure 5: Employment share of ICT specialists aged 35 or under, EU-27, 2014 and 2024 (%)



Source: Eurostat data (online data codes: isoc_sks_itsps, isoc_sks_itspe and isoc_sks_itspa).

The high shares in the CEE Member States in 2014 reflect the first wave of ICT specialists who entered employment during the post-2000 outsourcing boom. Significant numbers of young ICT specialists from CEE Member States may have migrated to western European tech hubs (like Amsterdam, Berlin, Copenhagen or Dublin), contributing to the relative rejuvenation in those Member States while depleting the youth share at home. In addition, as well as suffering brain drain, the ICT sectors in the CEE Member States are maturing and are more likely to be hiring and retaining more senior professionals and managers rather than entry-level developers. This too would be consistent with the shift observed in the age distribution.

Gender

The ICT specialist population remains heavily male dominated, with women making up less than one fifth of the specialist workforce in the majority of Member States. The female share of the EU-27 ICT specialist workforce has increased modestly, from 16.2 % in 2014 to 19.5 % in 2024 (see Figure 6). The highest shares of women were found in Estonia (27.6 %), Romania (27.3 %) and Bulgaria (27.0 %). However, Bulgaria saw a notable 4.8 pp decrease in its female share over the decade, when there was a sharp fall in the share of female IT graduates (Stoilova, 2023). The female share grew between 2014 and 2024 in all Member States except three: Bulgaria, Greece and Malta.

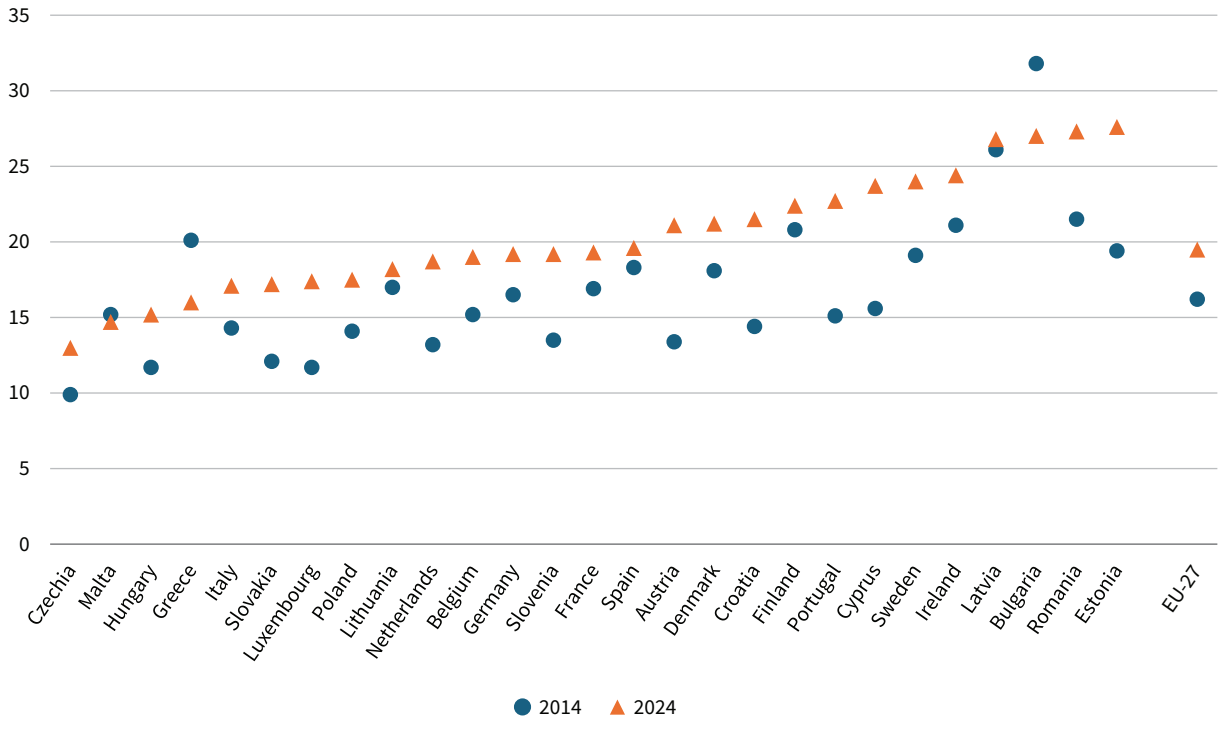
Research suggests that the high shares of women in IT employment in Member States like Bulgaria and Romania are partly due to the educational legacies of the socialist era, where the state-mandated 'STEM [science, technology, engineering and mathematics] for all' approach – as well as gender equality norms in the labour market more generally – temporarily bypassed the cultural stereotypes that limited women's entry into the field in western Europe (Hafkin et al., 2007). However, as these labour markets converge with traditionally western European capitalist economies, some of this high historical female share is being eroded.

Estonia (+ 8.2 pp), Cyprus (+ 8.1 pp) and Austria (+ 7.7 pp) saw the largest increases in female participation, suggesting that either national initiatives or shifting cultural norms are beginning to have an impact in at least some Member States. At the other end of the spectrum, Czechia (13 %) and Hungary (15.2 %) – exceptions to the generally higher shares of women in IT in CEE Member States – and Malta (14.7 %) report the lowest female participation rates. In Czechia, despite a small increase, seven out of eight ICT specialists are men.

Employment status

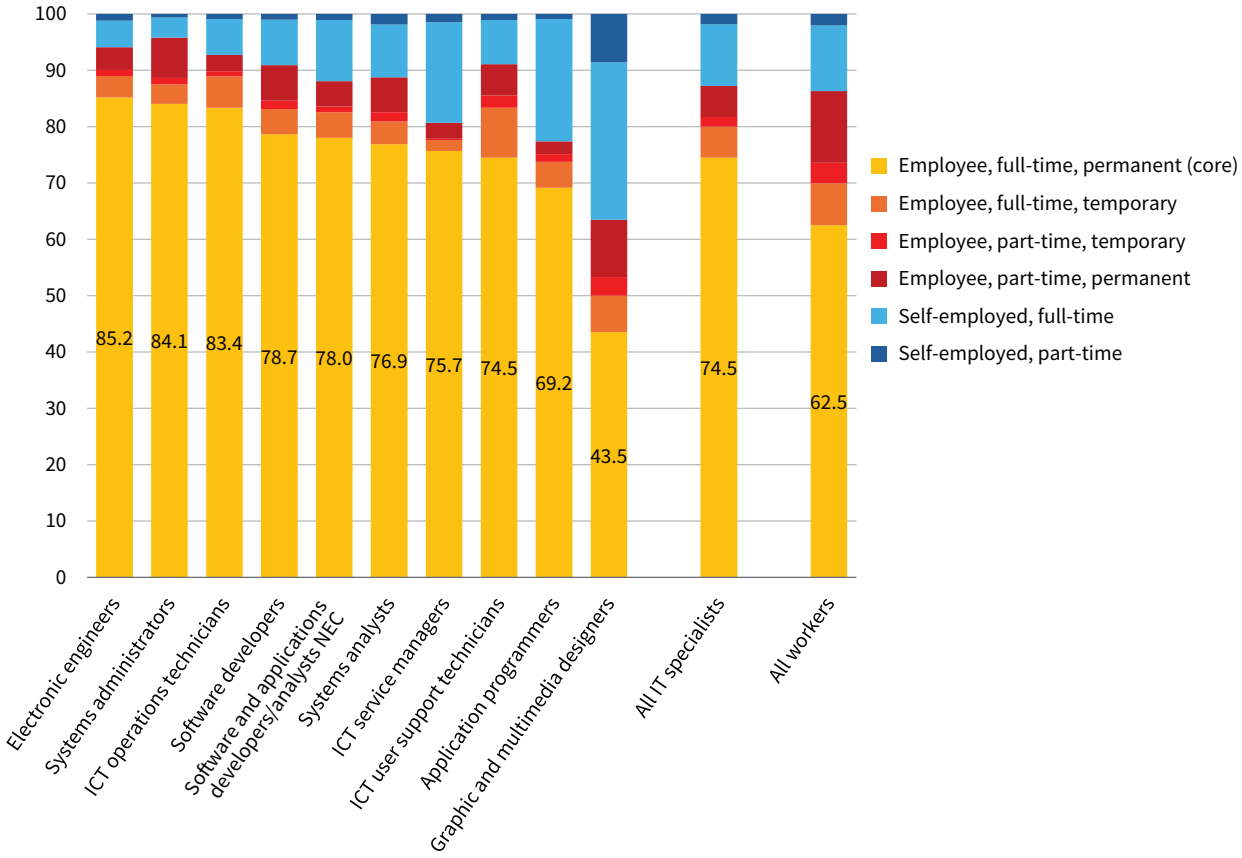
ICT specialist employment is characterised by high stability and a prevalence of standard employment arrangements. For most professionals in this sector, the most common employment model is a full-time, permanent employee contract – which we refer to below as 'core employment'.

Figure 6: Female share of ICT specialist employment, 2014 and 2024 (%)



Source: EU-LFS data (authors' elaboration).

Figure 7: Employment status for selected ICT specialist occupations, EU-27 (%)



Note: NEC, not elsewhere classified.
Source: EU-LFS data, ad hoc extraction (authors' elaboration).

Across all ICT specialists, nearly three quarters (74.5 %) are employees working on a permanent, full-time basis, compared with 62.5 % in the EU-27 workforce (see Figure 7). Given the high demand for ICT specialists, offering permanent contracts is an important strategy for firms in retaining ICT specialist staff and to prevent poaching by competitors. More generally, permanent, full-time employment is correlated with higher value-added roles, where the cost of recruitment or turnover is high and where employers have a strong incentive to provide stable, long-term conditions.

Technical and infrastructure roles show the highest shares of core employment status. Electronic engineers (85.2 %) and systems administrators (84.1 %) have the highest shares of employees with permanent, full-time contracts. The share of temporary contracts remains notably small across most ICT specialist occupations. Even in fast-growing roles such as those of software developers, only 4.5 % of employees are on full-time temporary contracts.

While the average self-employment rate for ICT specialists is around 12.8 % (combining full-time and part-time employment), certain roles show higher entrepreneurial or freelance activity. Graphic and multimedia designers (28.0 %) and application programmers (21.7 %) are the most likely to be full-time self-employed.

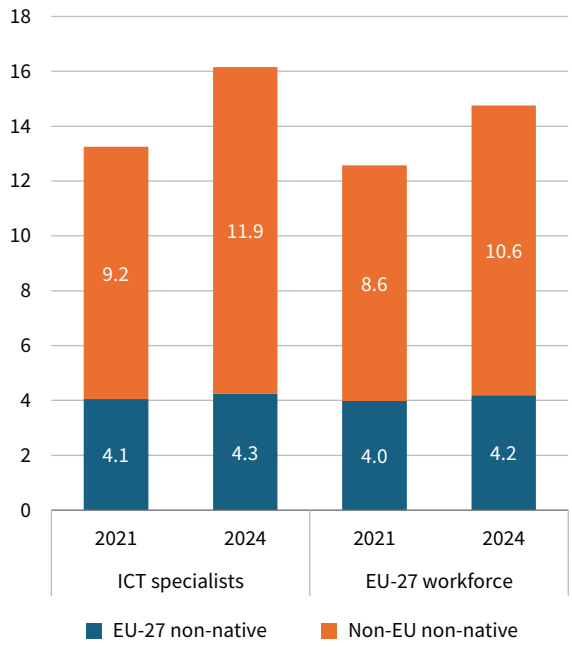
Graphic and multimedia designers are a distinct outlier within the occupations, with a lower-than-average share of 'core' employment (43.5 %) and the highest rates of employed and self-employed part-time work (see Figure 7). This occupation bridges the gap between the IT sector and the creative industries, which traditionally utilise more flexible work models. As already noted, it is also the IT specialist occupation with lowest current growth.

Labour mobility and migration

Skills shortages mean that employers in the EU are increasingly reliant on non-native employment to fill IT specialist vacancies. Qualitative aspects are discussed in more detail in the following section on labour shortages, while, here, we use EU-LFS data to illustrate recent developments. Figure 8 shows the change in the share of non-native ICT specialists – those born outside their country of employment – over the short time frame of 2021–2024 ([2]).

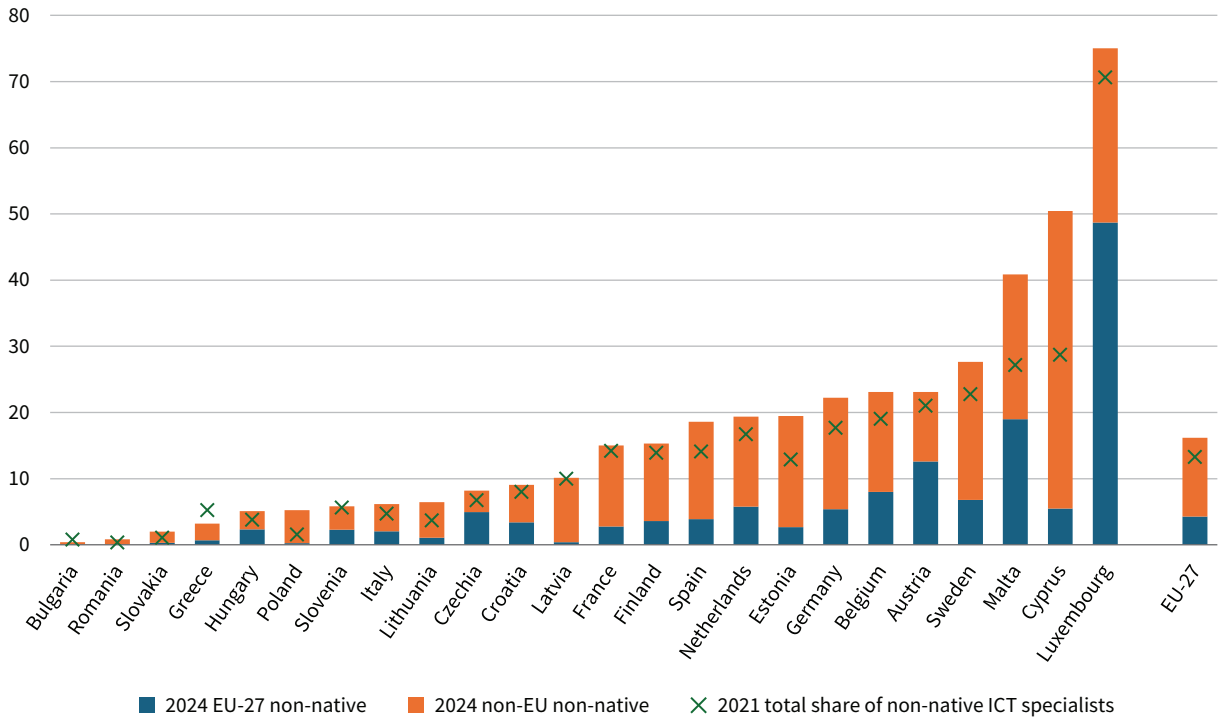
ICT specialists are more likely to be non-native compared with the average workforce. In 2024, 11.9 % of ICT specialists were born outside the EU, compared with 10.6 % in total EU-27 employment (see Figure 9). The share of ICT specialists born outside the EU-27 rose sharply from 9.2 % in 2021 to 11.9 % in 2024. This increase of 2.7 pp in just three years underscores the sector's increasing reliance on global recruitment to sustain its growth. The share of ICT specialists born in another EU-27 Member State (EU-27 non-native) also saw an increase, moving from 4.1 % to 4.3 %; however, the primary flow of talent for the IT sector is increasingly sourced from outside the EU rather than from internal EU mobility. This increase in non-EU hiring is also a

Figure 8: Share of non-native ICT specialists, EU-27, 2021 and 2024 (%)



Source: Authors, based on ad hoc extraction of EU-LFS data.

Figure 9: Share of non-native ICT specialists, by Member State, 2021 and 2024 (%)



Note: Estimates for Denmark, Ireland and Portugal (not shown) are based on partial data and are indicative only. '2021 total share of non-native ICT specialists' represents the 2021 baseline for the EU-27 non-native and non-EU non-native categories combined.
Source: EU-LFS data, ad hoc extraction.

([2]) Data are only available at the relevant level of detail from 2021.

result of national initiatives, such as greater flexibility in Ireland's national critical skills employment permits scheme (introduced in 2024; DETE, 2024), Malta's specialist employee and key employee initiatives and various digital nomad initiatives, as well as EU-level initiatives such as the EU blue card reform, which was designed to make Europe a more attractive destination for high-skilled professionals.

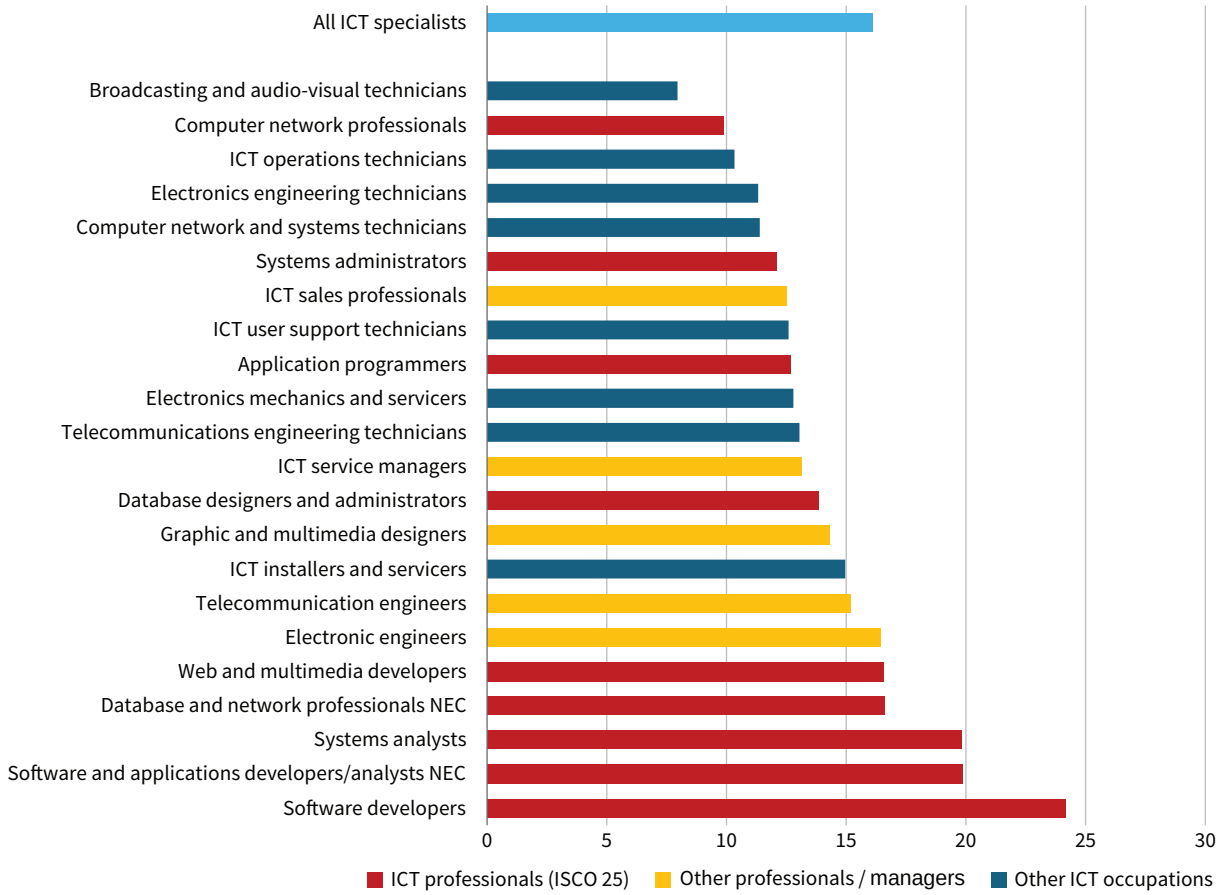
The share of non-native ICT specialists increased in nearly every Member State between 2021 and 2024. Five Member States stand out with exceptionally high shares of non-native employment. Luxembourg has the largest share of non-native ICT specialists, with 75 % of its ICT specialists being non-native (49 % from other Member States and 26 % from outside the EU). It is followed by Cyprus (50 %), Ireland and Malta (41 %) and Sweden (28 %). The high shares in Ireland and Luxembourg also reflect their status as European headquarters for multinational technology and financial services. These firms operate internal labour markets, moving specialists globally to where corporate hubs are located. An additional, important factor in Luxembourg is cross-border commuting from neighbouring Member States.

In most Member States, non-EU-born ICT specialists make up a much larger share of the workforce than those from other Member States. In Ireland, non-EU specialists account for 35 % of the workforce compared with just 5 % from other EU nations.

The '2021 total share of non-native ICT specialists' in Figure 9 highlights how rapidly these shares are rising. Cyprus saw the most dramatic increase, rising from 29 % to 50 % in just three years. Estonia also experienced a significant increase, with its non-native share rising from 12.9 % to 19.5 %. Larger Member States like Germany (+ 4.6 pp) and Spain (+ 4.5 pp) also saw clear upward trajectories. While CEE Member States have much lower shares of non-native ICT specialist employment, there are indications here too of an internationalising workforce. Poland, for instance, more than tripled its non-native share, from 1.6 % in 2021 to 5.2 % in 2024.

The demand for non-native expertise is greatest in jobs requiring higher skills. The 2024 employment data for the EU-27 reveal a clear correlation between occupational skills level and the share of non-native workforce. As illustrated in Figure 10, the highest share of non-native employment is found in the 'ICT professional' ISCO 25 occupational group (in red in Figure 10), which encompasses high-level

Figure 10: Share of non-native ICT specialist employment by occupation, EU-27, 2024 (%)



Source: EU-LFS data, ad hoc extraction (authors' elaboration).

specialisations, such as software development and systems analysis, and is one of the main constituent groups of 'ICT specialists', alongside ICT technicians, ICT managers and other ICT-related occupations.

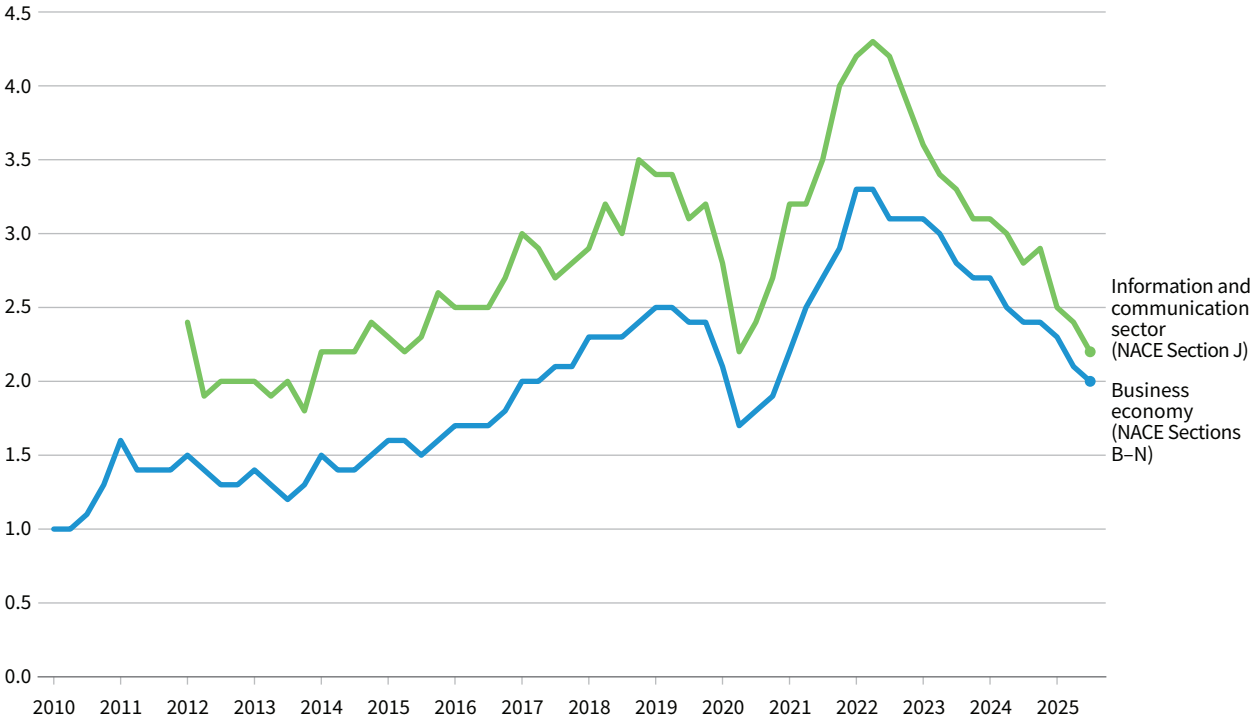
In 2024, at least one in five systems analysts and software developers was non-native born. It is also in these professional categories where recent employment share growth has been strongest. Between 2021 and 2024, the following occupations witnessed the largest increases in non-native employment share: software and applications developers and analysts (+ 5.3 pp), database and network professionals (+ 5.3 pp), application programmers (+ 4.8 pp) and software developers (+ 4.7 pp). Other professional categories (in yellow in Figure 10) and other ICT occupations (mainly technician or associate professional grade; in blue in Figure 10) tend to have non-native shares that are closer to that of the workforce as a whole. Growth in the non-native share for these occupations has also been slower on average, indicating that demand is more likely to be satisfied by local supply compared with emerging higher-skilled specialist occupations where demand is increasingly met from non-EU countries.

Labour shortages in IT

Across the EU, different indicators point to sustained labour shortages in IT, as recorded by official statistics at the EU level, and within most individual Member States, as reported by the Network of Eurofound Correspondents. Shortages are evident within the information and communication sector, and are intensified by the fact that ICT specialists are in high demand across all sectors.

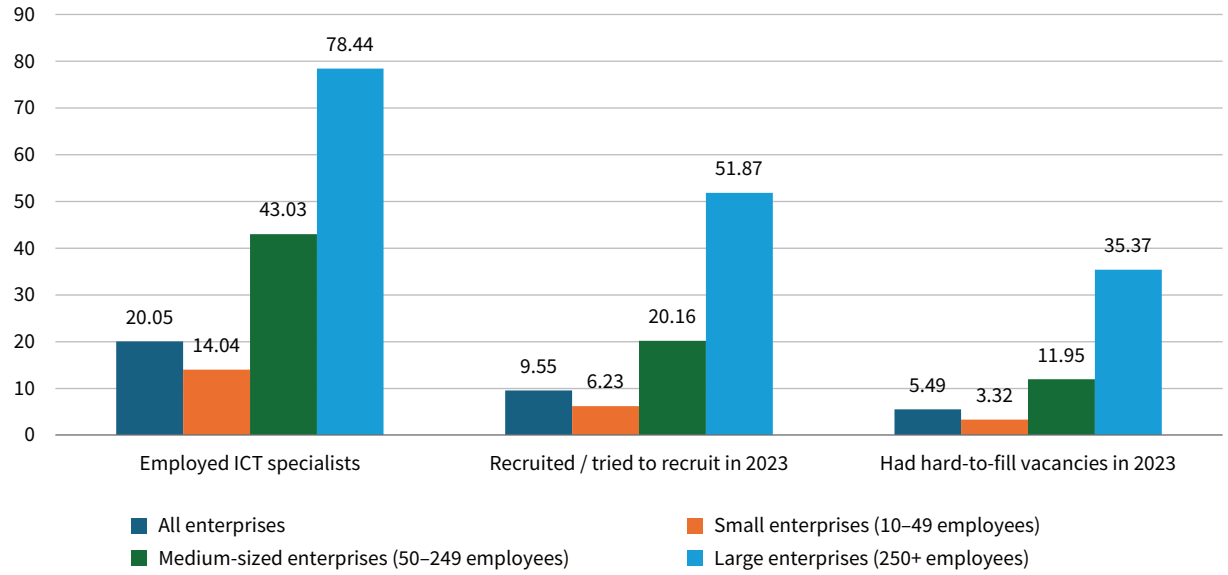
From the sectoral perspective, the information and communication sector (NACE Section J), which employs a large share of ICT specialists, has consistently experienced higher vacancy rates – defined as the rate of open job positions relative to occupied posts, and indicative of labour shortages – than other sectors. Figure 11 compares the vacancy rate of the information and communication sector with that of the broader business economy (NACE Sections B–N), based on job vacancy statistics from Eurostat. As of the third quarter of 2025, vacant positions in the information and communication sector amounted to 2.2 % of occupied positions, somewhat higher than the 2.0 % rate in the broader business economy. The information and communication sector has had a relatively higher share than the business economy at large since 2022, although it has declined from its peak in 2022, when the vacancy rate was 4.3 % in NACE Section J and 3.3 % in the business economy.

Figure 11: Job vacancy rates in the information and communication sector and business economy, EU-27 (%)



Note: The data are not seasonally adjusted.
Source: Authors, based on Eurostat data (online data code: jvs_q_nace2).

Figure 12: Share of enterprises employing ICT specialists, recruiting ICT specialists or with hard-to-fill ICT specialist vacancies, EU-27, 2023 (%)



Note: All sectors, excluding agriculture, forestry and fishing; mining and quarrying; and the financial sector.
Source: Authors, based on Eurostat data (online data codes: isoc_ske_itspe and isoc_ske_itrcrs).

Considering IT workers as an occupational group rather than an industry allows us to paint a more detailed picture.

Despite the growing demand for digital services in companies of all kinds, ICT specialists remain sought-after specialised workers, mostly employed by larger companies. Based on the ISOC_E, in 2023, only around 20 % of EU companies reported employing ICT specialists, as shown in Figure 12. Over three quarters (78.4 %) of enterprises of 250 employees or more reported employing ICT specialists, while just under 1 in 2 (43.0 %) medium-sized enterprises of 50–249 employees did so. Among small companies of 10–49 employees, only 14 % employed ICT specialists. Around 1 in 10 EU enterprises (9.6 %) reported that they recruited or tried to recruit ICT specialists in 2023 (the year preceding the survey). The rate was much higher in large enterprises (51.9 %) than in small enterprises (6.2 %). A majority (57.5 %) of those companies that tried to recruit ICT specialists in 2023 reported difficulties in filling those vacancies.

Evidence from different Member States, gathered from the Network of Eurofound Correspondents, also shows that the IT sector at large faces persistent, structural labour shortages, although the intensity of these pressures varies significantly by Member State.

In most Member States, a majority of employers reported at least some difficulties in recruiting ICT specialists, or IT workers in general. For example, in 2022, employer surveys in Germany reported that 72 % of companies advertising IT positions were struggling to fill them, primarily owing to a lack of qualified applicants. Employer surveys in Italy report more acute (and recent) shortages, with 78 % of companies unable to find candidates with the necessary skills in 2025. Austria reports that more than 50 % of firms face acute IT staff shortages, with studies estimating that the country requires an additional 25 700 to 27 800 ICT specialists to meet demand. In Greece, 89 % of companies reported vacant positions for ICT specialists in 2022. In Sweden, 83 % of employers in the IT sector said it is 'quite' or 'very' difficult to find workers with the right competencies.

By contrast, a few Member States report less acute or declining IT labour shortages, with shortages notably peaking around 2022. In Spain, although the shortfall in ICT specialists in 2022 was estimated at 120 000, in 2023 fewer than 1 in 3 employers (30.15 %) reported difficulties in hiring ICT specialists, one of the lowest rates in the EU. The Netherlands experienced a slight improvement in terms of the ICT labour shortage in 2024, with a 'sharp decline' ([3]) in open vacancies in the Dutch IT sector compared with the previous year.

([3]) Unless otherwise specified, any quotations in this report are taken from contributions provided by the national correspondents in the Network of Eurofound Correspondents.

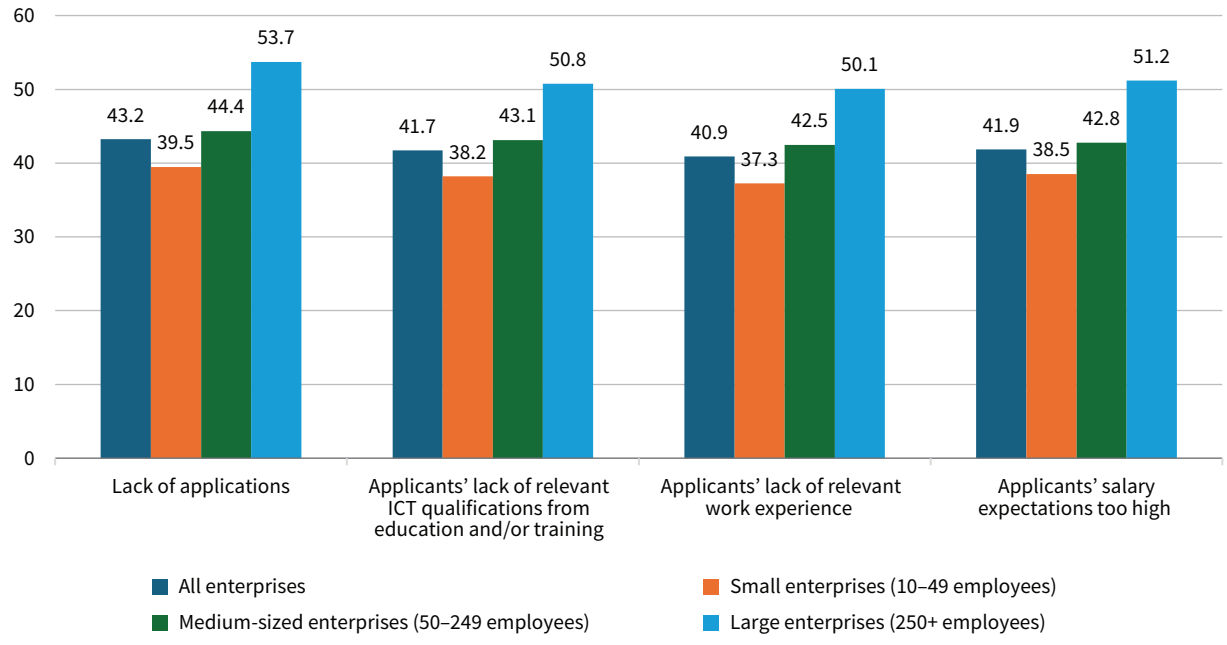
By late 2024, a majority (58 %) of Dutch employers in the IT sector reported being 'not or hardly affected' by shortages. Likewise, in 2024, Romania reported that shortages were at their 'lowest level of the past decade' owing to a 2023 sectoral slowdown. In Czechia, the shortage situation has shifted from 'acute' to 'not so dramatic', which is attributed to AI replacing certain junior-level roles. Finland is an interesting case: official data suggest an 'oversupply of labour' in most ICT occupations, with only cybersecurity specialists currently in short supply, although that may also stem from the slowing Finnish economy and rising joblessness.

Most vacant positions for ICT professionals are concentrated in technology clusters located in major urban centres, mostly capital cities (as discussed in the 'Strengthening IT clusters' section). In Spain, Madrid and Barcelona account for 44 % and 52 % of all ICT vacancies, respectively. Similarly, Bratislava hosts roughly half of all national IT jobs in Slovakia, while Prague and Central Bohemia dominate demand in Czechia. In France, the Île-de-France region (Paris) remains the primary pressure point.

In relative terms, less-developed regions also report tight labour markets for IT workers, with relatively more vacancies per employed specialist, mostly because of a lack of local supply capacity. In Italy, the most severe shortage conditions are concentrated in southern regions like Basilicata (with labour tightness up to 367 % higher than average, or more than three and a half times the typical ratio of vacancies to occupied posts) and Apulia (with labour tightness up to 340 %), where local supply capacity is lowest. In Austria, the southern part of the country faces higher relative shortages than the western part. In Greece, Thessaly is experiencing higher 'tightness' for IT workers than the national average. For smaller Member States like Estonia and Malta, shortages are assessed on a nationwide basis rather than on a regional basis.

Employers in the 2024 ISOC_E reported that several factors contributed to the shortages: 43.2 % cited lack of applications, 41.7 % pointed to a lack of relevant ICT qualifications, 40.9 % said that applicants lacked relevant work experience, while 41.9 % stated that applicants' salary expectations were too high. Interestingly, these concerns are cited by employers of all sizes at approximately the same rate – although they are somewhat more common in larger enterprises – suggesting widespread issues in recruitment (see Figure 13). Collectively, these responses point to a restricted pool of talent for ICT specialists at all skills levels. At one end of the spectrum, the fact that a plurality of employers (40–50 %) report a lack of applications and note applicants' lack of qualifications or work experience may reflect concerns regarding the supply of workers with adequate skills: in terms of both headcount and skills levels. At the other end of the spectrum, a similar share of employers also say that the salary expectations of applicants are too high, and this may mean that when employers do receive applications from qualified professionals, they do not pay salaries commensurate with their experience. It is worth remembering that employers compete internationally for IT talent and that multinational IT companies offer attractive compensation packages. In particular, the IT sector in the United States sets the global benchmark

Figure 13: Share of enterprises with difficulties in filling vacancies for ICT specialists, EU-27, 2023 (%)



Note: All sectors, excluding agriculture, forestry and fishing; mining and quarrying; and the financial sector.
Source: Authors, based on Eurostat data (online data code: isoc_ske_itrcrs).

for IT compensation and competes with EU domestic employers through local branches, or, in some cases, by directly hiring individual ICT specialists remotely.

According to evidence from the different Member States collected by the Network of Eurofound Correspondents, a combination of factors has contributed to the labour shortages in IT, including demand growth within and beyond the IT sector, rapid technological innovation, structural problems in education, demographic shifts and global competition for skilled labour. Employment growth has been most notable in the IT sector proper, but has also spread to other industries like finance, manufacturing and healthcare, which now compete for the same talent pool.

Labour mobility and migration can either improve or worsen labour shortages, depending on the attractiveness of salary and working conditions. Immigration plays a critical role in Germany's mathematics, IT, natural sciences and technology sectors, which include ICT specialists. Between 2013 and 2023, the share of non-EU nationals working as academically qualified experts in these fields grew by more than 200 %. In Estonia, non-EU workers accounted for roughly 20 % of software specialists and 30 % of employees in the start-up sector in 2023. In several Member States, IT workers are among the leading occupations to be granted work permits. This is the case, for example, in Sweden, where, in 2021, the majority of workers from non-EU countries came from Asia (with India specifically accounting for 22 %). In Ireland, employers in the IT sector are among the biggest users of the critical occupations employment permits systems.

However, according to national correspondent contributions, Member States like Bulgaria, Greece, Hungary, Italy, Romania and Slovakia experience 'brain drain' as their IT workers migrate to western and northern Europe or to the United States for significantly higher salaries and better working conditions. 'Brain drain' and 'brain gain' often coexist: in Spain, IT salaries are roughly 49 % higher than the national average, but they remain far below those offered in the United Kingdom or in Germany. As a result, Spanish IT workers often migrate abroad or remain in Spain while working remotely for foreign firms that offer higher salaries. At the same time, Spain is successfully attracting a large number of non-EU nationals, especially from Latin America, owing to language and cultural proximity. Spain also aims to attract 'digital nomads': the 2022 Startup Law introduced visas allowing non-EU nationals to live in Spain while working remotely for foreign companies and sped up the processing of visa and work permits.

This underlines the fact that labour mobility for the IT workforce is as likely to be virtual as physical. According to the EU-LFS, nearly two thirds of EU-27 ICT specialists (63 %) worked from home at least some of the time in 2024, around three times the share in the working population as a whole. ICT specialist work is among the most 'teleworkable' of any occupational group. The post-COVID-19 expansion of remote working has the potential to ease some forms of skills and educational mismatch across the IT sector. Using data from the two waves of the European Skills and Jobs Survey (2014 and 2021), Redmond et al. (2025) find that the incidence of overeducation in the EU fell from 28 % to 21 % between 2014 and 2021, and that the expansion of remote working driven by the COVID-19 pandemic contributed to this decline by enabling employees to better align their qualifications and skills with job demands. This matching function of remote working is particularly relevant for IT occupations and suggests that labour shortages may be partly offset, particularly for senior-level roles, by the greater geographic flexibility that remote work affords.

Technological change and demand for new skills and job titles

Digital transformation has increased demand for experts in emerging technologies, specifically AI, data science and cloud computing. It is also the case that the COVID-19 pandemic accelerated the digital transition, requiring increased infrastructure and labour for remote work and home offices, according to qualitative evidence from the Network of Eurofound Correspondents.

Senior and specialised technical profiles tend to have the most acute shortages. The most common job titles experiencing shortages are software developers and programmers, particularly those with expertise in back-end operations (that is, the server side of applications), full-stack development (that is, both the server and client side of applications) or specialised programming language frameworks. Cybersecurity is also a critical area, often described as the most difficult profile to fill, owing to the specialised nature of security architecture and incident response, which requires being up to date with the latest threats and best practices.

Administrative and management roles, particularly systems analysts, IT architects and digital project managers, also face significant tightness. In several markets, demand is increasingly segmented by experience; for example, Czechia and the Netherlands report extreme scarcity of senior professionals while demand for junior roles fluctuates, owing to automation. There is also a growing need for specialists who bridge expert IT skills with domain-specific knowledge in other sectors, referred to as 'π-shaped specialists' in Estonia, because the Greek letter π looks like a bridge.

The European Centre for the Development of Vocational Training (Cedefop) provides a more detailed analysis of the specific digital skills in demand for ICT specialists

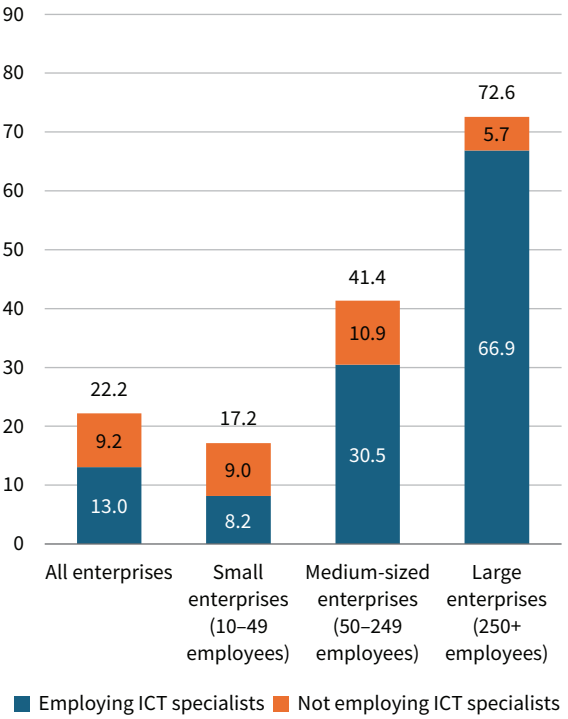
and other roles – such as emerging programming languages and technologies – from online job advertisements (Cedefop, 2023a, 2023b).

Training

Inadequate training from academic and vocational providers, resulting in skills mismatches, is a concern indicated in many of the national contributions. This includes both the quantity of specialists trained by the education system and the skills they learn. Some national education systems cannot produce enough specialists; most Member States that track current (and future) demand for ICT specialists with the number of university graduates find that the education system cannot keep up. For example, Slovakia needs 10 000 new specialists per year but, as yet, produces only 3 500 graduates. Employers sometimes report that academic training is too theoretical and lacks focus on industry requirements, as reported, for instance, in Greece and Italy. Education providers also reportedly struggle to update curricula as fast as technology evolves. The pace of technological development means that technical skills can become obsolete in ever-shorter cycles.

Given the challenges that employers face in finding IT specialists, and their reported dissatisfaction with education suppliers, one response could be the provision of relevant technical training to their own employees. Overall, however, relatively few employers provide frequent training to their employees, either to their ICT specialists (if they employ any) or to any other employee, to develop or upgrade their ICT skills. Based on the 2024 ISOC, only 22.2 % of enterprises with 10 or more employees provided training to their employees to develop ICT-related skills in 2023: 13.1 % employed ICT specialists while 9.2 % did not. Large enterprises, which are more likely to employ ICT specialists, are also more likely to provide training: among large enterprises of 250 or more employees, nearly three quarters (72.6 %) provided ICT training in 2023 – and the large majority of those employed at least one ICT specialist. By contrast, small enterprises of 10–49 employees were much less likely to provide ICT training: only 17.2 % did so, with a slight majority not employing an ICT specialist (Figure 14).

Figure 14: Share of enterprises providing ICT-related training to their employees, by enterprise size, EU-27, 2023 (%)



Note: Includes enterprises of 10 or more employees in all sectors, excluding agriculture, forestry and fishing; mining and quarrying; and the financial sector.
Source: Authors, based on Eurostat data (online data code: isoc_ske_itts).

With formal education and on-the-job training struggling to produce IT professionals in sufficient numbers, governments and organisations have implemented several policies promoting training in digital skills (Box 1).

Box 1: 'You too in IT' – training women for careers in IT in Slovakia

Shortages in IT receive policy attention at every level of government, from the regional level to the EU level. The EU Digital Decade targets include reaching 20 million ICT specialists and ensuring that 80 % of adults have at least basic digital skills by 2030. In addition, with women still accounting for a minority of ICT specialists, there are dedicated initiatives to boost female IT employment.

A notable grassroots initiative aimed at increasing women's participation in ICT comes from Slovakia. The non-profit organisation Aj Ty v IT ('you too in IT') is at the centre of a long-running non-governmental initiative supported by companies such as IBM, Accenture, Dell and Siemens. The initiative combines outreach, training and mentoring to attract women and girls to digital careers.

Founded in 2012, Aj Ty v IT has become Slovakia's flagship organisation for promoting women in technology. Operating as a non-profit association, it collaborates with universities, secondary schools and major IT employers to introduce girls to coding at an early age and to support career transitions for adult women. Its portfolio ranges from one-day 'Coding in a skirt' workshops for teenagers to intensive three-month bootcamps in web

development and data analytics. By 2024, the initiative had reached more than 50 000 participants nationwide, with sustained corporate sponsorship ensuring stable funding and regular expansion into new regions. Its activities are co-funded by corporate sponsors and by EU structural funds channelled through the Ministry of Education, Science, Research and Sport of the Slovak Republic.

Evaluations presented at the 2023 national Digital Skills conference showed that more than 70 % of course graduates secured ICT employment or further ICT-related education within six months of completion, a placement rate significantly above national averages for adult training schemes. Eurostat's Digital Skills and Jobs Platform also cites Aj Ty v IT as a good practice example for gender inclusion ([4]). While female employment in ICT remains low, at roughly 15 % of Slovak ICT specialists, this programme demonstrates measurable success in expanding the pipeline of qualified female candidates.

In summary, the IT sector has been experiencing labour shortages across the EU, with some exceptions, and firms in all sectors report difficulties in recruiting IT professionals. The rapid growth in demand for ICT specialists, combined with rapid technological change, has outpaced the ability of education systems to produce sufficient numbers of qualified specialists. The differences in remuneration between Member States (and between the EU and the United States) has led to 'brain drain' in low-wage Member States, where employers struggle to hire ICT specialists, who command high wages in the global economy. To increase their ranks, many Member States provide work visas to IT workers. Despite the shortage, relatively few employers overall, and mostly larger enterprises, report providing training to ICT specialists or training other employees in IT skills. Given the low rate of female representation among ICT specialists, more targeted initiatives aimed at helping women enter the IT workforce are needed.

([4]) https://digital-skills-jobs.europa.eu/en/community/networking/organisations/aj-ty-v-it.

2 Quality of work in IT

In this chapter, we will mainly refer to EWCS 2024 data to compare how ICT specialists report dimensions of their job quality compared with the workforce more generally. We will also explore the – unsurprisingly high – extent to which ICT specialists report that their work involves digital technologies and the perceived impacts of such technologies: are these technologies task-replacing or task-creating? Given the demands of rapid technological change, we will look at how upskilling occurs for ICT specialist workers. Finally, we will explore notable gaps in the working experience of male and female ICT specialists.

Job quality dimensions

Eurofound has developed a conceptual framework of job quality across seven dimensions (see Box 2) and has formulated indices based on EWCS data to measure all seven dimensions. Job quality of ICT specialists is markedly higher than that of EU workers across all dimensions, except Work intensity, where it is close to being equal (see Figure 15). The gaps are largest in the dimensions of Skills and discretion, and Earnings.

Box 2: Eurofound's job quality indices

Eurofound has operationalised the concept of job quality in seven dimensions (Eurofound, 2012), as follows.

Earnings. This index measures the extent to which a job meets the need to earn one's livelihood. The level of earnings, their predictability and their fairness in relation to the effort put in make up the index.

Working time quality. This index addresses the quality of time spent at work. It focuses on the duration of working time, the timing of hours (atypical working hours), the flexibility and predictability of hours, and the control that workers have over their working time.

Prospects. This index addresses workers' need for safety and control over the future. It consists of subdimensions covering career prospects, job security, vulnerability and the employment status of the workers.

Skills and discretion. This index addresses workers' need to use and grow their skills at work and develop through work experience. It considers the cognitive dimensions of the work and opportunities for development, decision latitude, organisational participation and training.

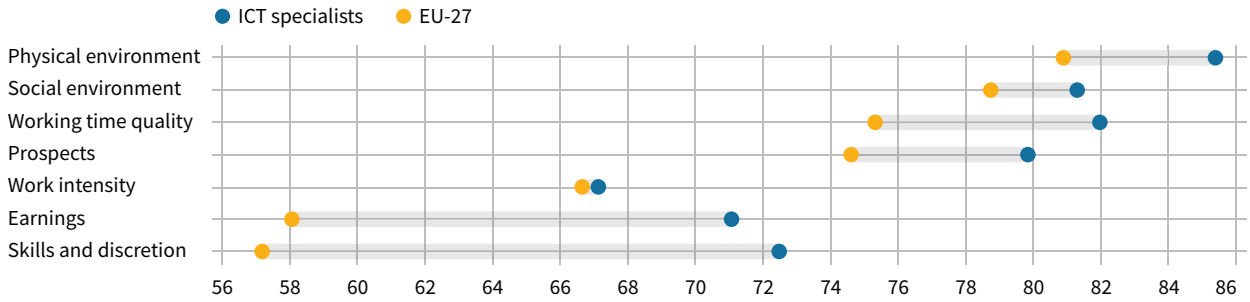
Work intensity. This index refers to the rhythm at which work is performed during working time. It considers the quantity of demands and the emotional demands of the work, and interdependency between pace constraints.

Social environment. This index addresses workers' need for supportive relationships at work with colleagues and managers and the absence of adverse social behaviours, and includes the quality of management.

Physical environment. This index captures exposure to physical risks and to physical demands.

See Eurofound (2026a) for details of how the job quality indices are constructed using the EWCS data.

Figure 15: Job quality of ICT specialists, EU-27



Note: All job quality indices are ranked between 0 and 100, with 0 being the lowest and 100 the highest. Job quality scores are comparable within dimensions but not between dimensions.
Source: EWCS 2024 data (authors' elaboration).

Career **Prospects** of the ICT specialist workforce are significantly higher than average (18 pp), with 64 % agreeing that they have good prospects for career advancement. While **Working time quality** is higher than that for the EU-27 workforce, the picture by subdimension is more nuanced. With regard to the thresholds set in the European Working Time Directive, 9 % report working at least 48 hours a week (EU-27, 11 %), while 20 % report working at least one day per month with fewer than 11 hours of rest between the end of a work period and the beginning of the next consecutive work period. ICT specialists are flexible in their working time, however, with 78 % of ICT specialists able to take a break when they wish (EU-27, 51 %) and 47 % finding it easy to take one or two hours off to take care of private matters (EU-27, 29 %). ICT specialists also have greater predictability of working hours and greater control over their schedules; only around one quarter (27 %) have working hours set by the company with no possibility for change (EU-27, 54 %).

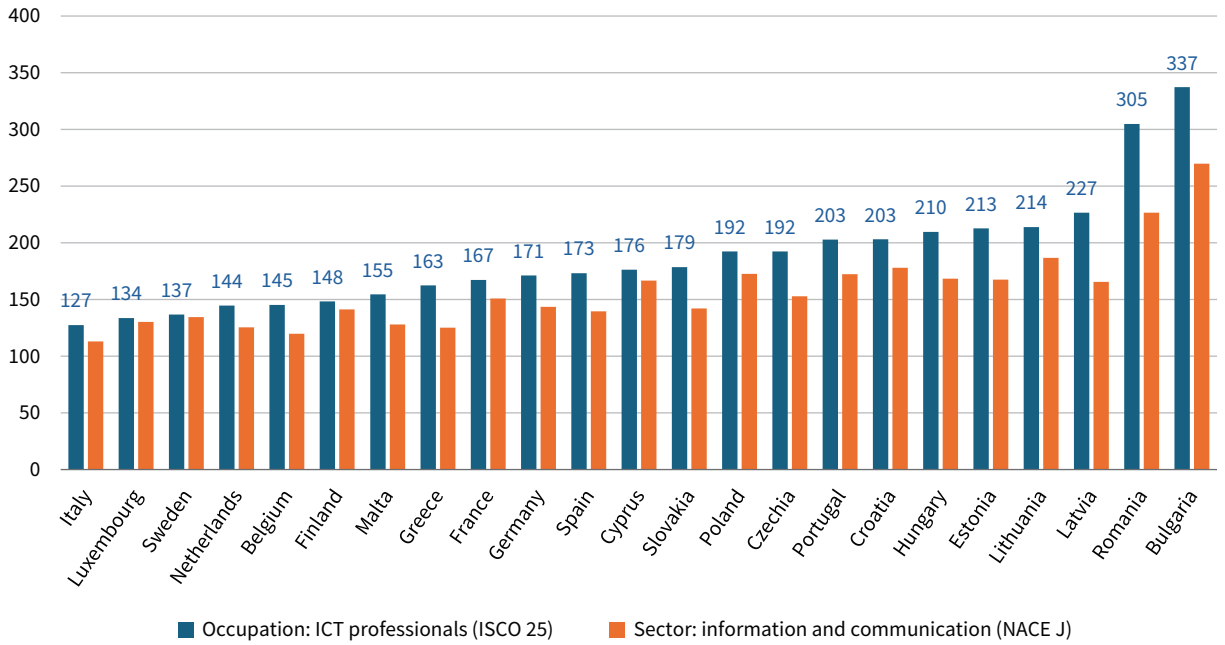
When **Social environment** is considered, ICT specialists experience lower exposure to adverse social behaviours (such as bullying) and are somewhat more likely to report high levels of social support from colleagues (+ 3 pp) and managers (+ 5 pp). Given the nature of their work, it is not a surprise that ICT specialists report comparatively low levels of workplace physical environment risk. The only exceptions are for sitting for long periods (91 % versus 58 % for the EU-27) and repetitive movements (68 % versus 61 % for the EU-27).

From the qualitative contributions of the Network of Eurofound Correspondents, the issue of **Work intensity** and work intensification was raised as a concern for ICT workers. This is a dimension in which their relative performance is nearer EU workforce averages (that is, less positive than other dimensions). Fewer ICT specialists work at high speed (29 % versus 35 % for the EU-27) or report not having enough time to do their job (7 % versus 10 % for the EU-27), but they are more likely to report frequent disruptive interruptions to their work (47 % versus 39 % for the EU-27).

Earnings

According to data from the SES, ICT professionals (that is, those under ISCO 25, who accounted for around half of employment of the ICT specialist group in 2024) are among the highest paid of the occupational categories. Median hourly earnings are significantly above average in all Member States, with considerable variation between countries: ICT professionals earn 27 % above the national median in Italy and more than three times the national median in Bulgaria and Romania. This is also the case for the broader information and communication sector, although here the differentials are not so great (Figure 16).

Figure 16: Median hourly earnings for ICT professionals and information and communication sector employees (median country earnings for all employees = 100)



Note: Excludes apprentices and the following sectors: public administration, agriculture, activities of households as employers and activities of extraterritorial organisations and bodies. Data are not available for ICT professionals for Austria, Denmark, Ireland and Slovenia. The SES mostly reports occupation at the ISCO two-digit level. This does not allow to identify precisely ICT specialists, which are defined as a collection of ISCO four-digit occupations, and so the chart reports figures for IT professionals (ISCO 25), which accounts for 52 % of employment in the ICT specialists group in 2024.
Source: SES 2022 data (authors' elaboration).

Additional evidence from the EWCS allows us to observe additional earnings dimensions and to identify ICT specialists more precisely. ICT specialists report earning more; they also report greater earnings predictability and that their earnings are fair in relation to their efforts. A large majority (70 %) of ICT professionals can predict their earnings in the next three months quite accurately (EU-27, 61 %). A higher share (70 %) of ICT professionals agree that they are fairly paid in relation to their efforts (EU-27, 57 %). They are also nearly twice as likely to earn variable earnings supplements in the form of team- or company-based performance payments (41 % versus 22 % for the EU-27).

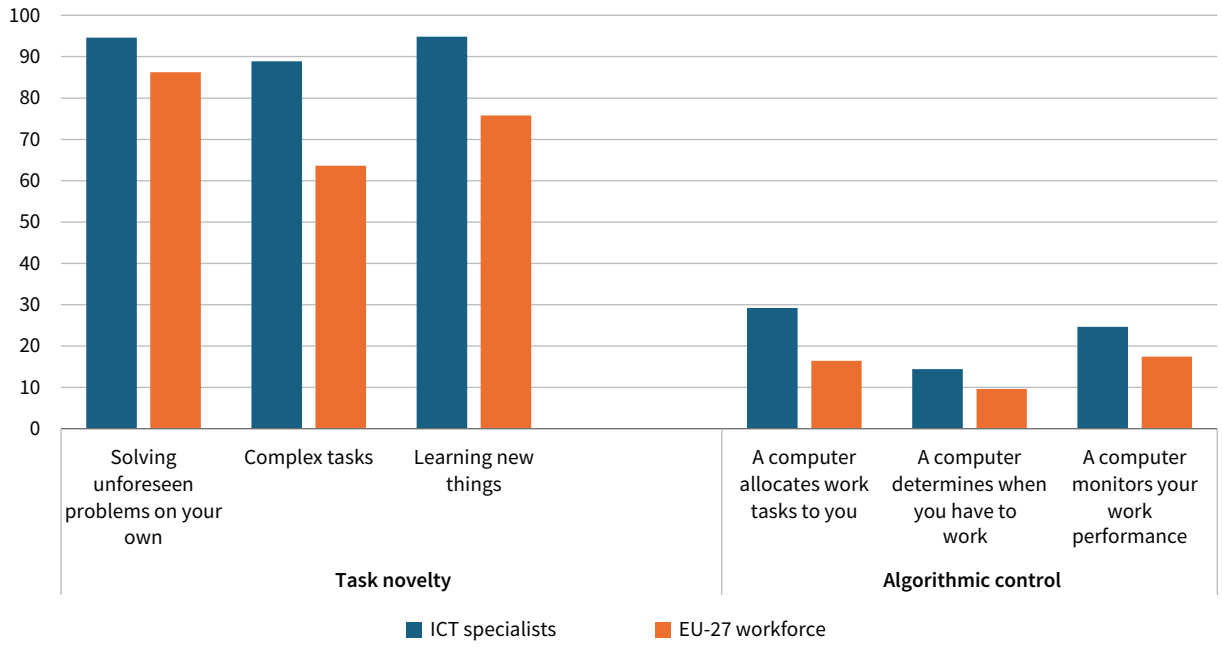
Skills: tasks and technology use

ICT specialists report significantly higher levels of task novelty across all categories measured, compared with the general EU-27 workforce. Specifically, nearly 95 % of ICT specialists report solving unforeseen problems and learning new things as part of their job, compared with 86 % and 76 %, respectively, of the general population. The most striking gap is in the performance of complex tasks, which 89 % of ICT specialists report (25 pp higher than the EU average). This high level of task novelty and complexity is a hallmark of knowledge-intensive work. Rapidly evolving technology obliges workers to constantly acquire new knowledge. At the same time, ICT specialists are also more exposed to forms of algorithmic management or oversight than the average worker (Figure 17).

Approximately 29 % of ICT specialists have their work tasks allocated by a computer (compared with 16 % on average for all other occupations in the EU-27) and 25 % have their performance monitored by software (compared with 17 % on average for all other occupations in the EU-27). While algorithmic management is often discussed in the context of 'gig work' or low-wage service roles, the EWCS data highlight its prevalence in IT work. This can be driven by the adoption of Agile or DevOps work organisation methodologies, which are increasingly common in IT settings. These methodologies utilise software to automatically assign tickets, track progress, monitor code quality, etc. Even in high-skill roles, technology is being used to quantify and streamline work processes. Therefore, while ICT specialists enjoy high levels of autonomy and rich work content (task novelty) simultaneously, they are more likely to be operating under advanced systems of digital oversight and automated coordination.

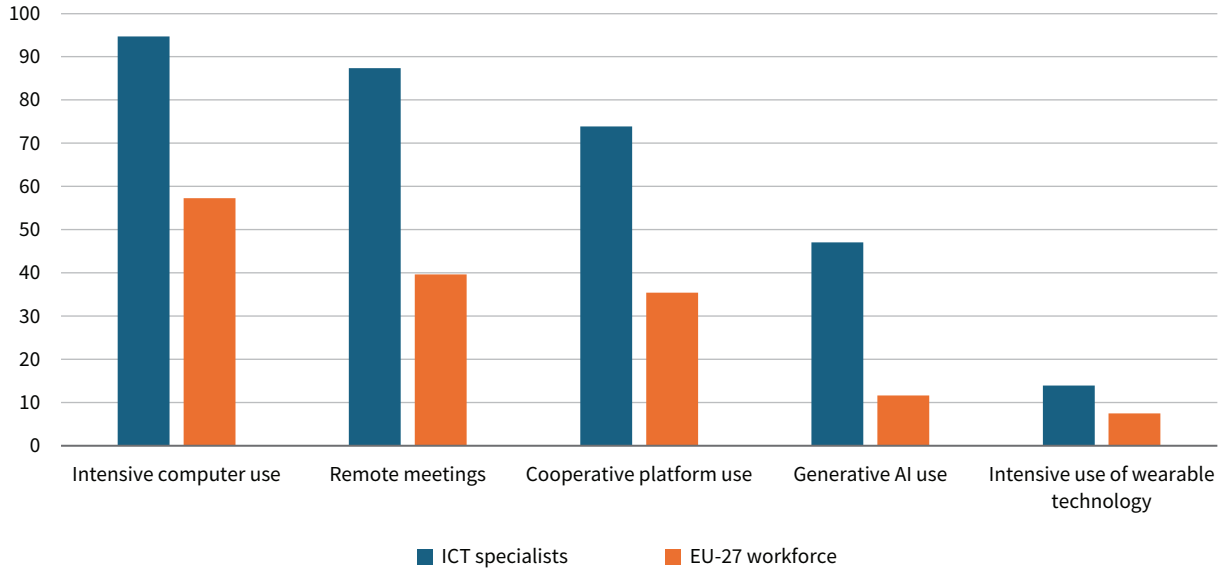
ICT specialists unsurprisingly report high levels of intensive use of computers (95 %, compared with an average of 57 % for all other occupations in the EU-27; see Figure 18). They are also more than twice as likely as the average worker to engage in remote meetings (87 % versus 40 %) and use cooperative platforms (74 % versus 35 %), suggesting that, for them, the office is increasingly digital and collaborative rather than physical. The heavy reliance on cooperative platforms

Figure 17: Task novelty and algorithmic management, EU-27 (%)



Note: Task novelty questions are binary yes/no questions and the bars represent those answering yes; algorithmic control questions are five-category Likert questions and the bars represent those answering 'All of the time' or 'Most of the time'.
Source: EWCS 2024 data (authors' elaboration).

Figure 18: Use of different digital technologies, EU-27 (%)



Source: EWCS 2024 data (authors' elaboration).

and remote meetings confirms the shift in the spatial organisation of IT work that is also evident in a much higher share of remote work. ICT specialists appear to use technology to maintain a constant, virtual connection with their colleagues and to facilitate project work regardless of location. According to 2024 EU-LFS data, the share reporting working from home 'sometimes' or 'usually' was almost three times greater than the average (63 % versus 23 %).

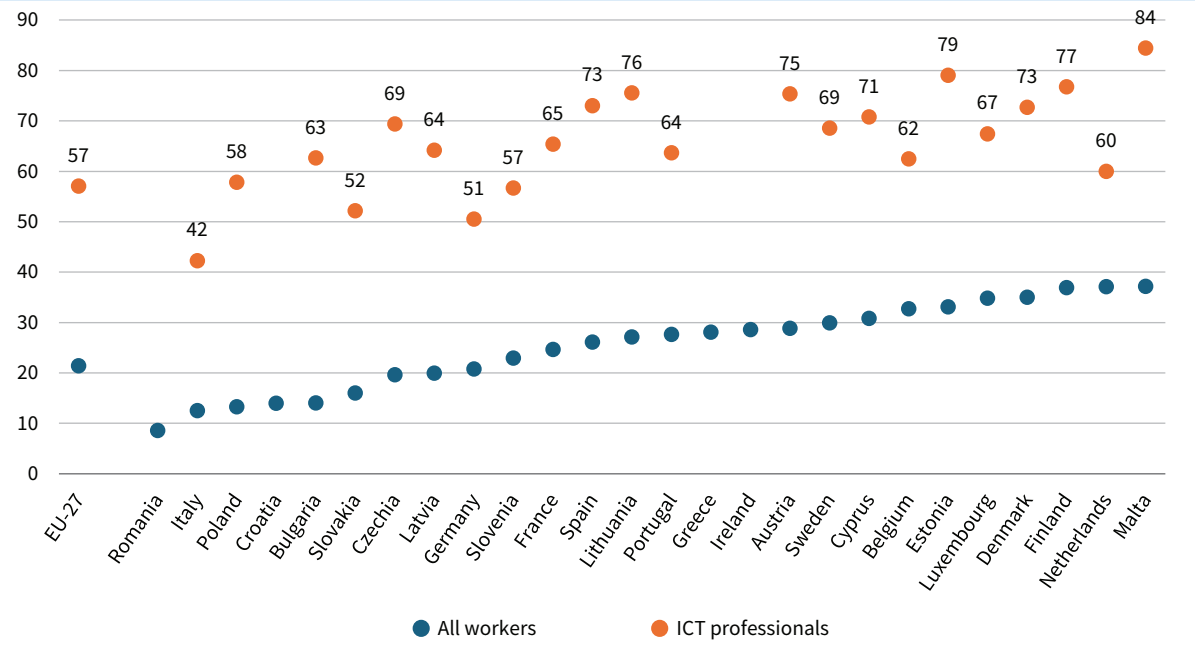
At the time of the EWCS in 2024, nearly half (47 %) of ICT specialists were already using generative AI tools, compared with just 12 % of the general EU-27 workforce (see Box 3 for updated Eurostat Survey on ICT Usage (ISOC) data). ICT specialists have been early adopters and testers of AI integration in the workplace. Rather than replacing their work, tools like Claude Code can work as an assistant that handles low-level coding and syntax tasks efficiently. This may have productivity benefits for ICT specialists (Eloundou et al., 2024), although it may also reduce demand for the younger and entry-level IT workers (Brynjolfsson et al., 2025), who were most likely to do such work in the past.

Box 3: Recent survey data on generative AI use at work

More recent comparative data from the ISOC update findings from the EWCS on generative AI adoption (Figure 19). With data collected a year later, the average take-up of generative AI tools for work across the EU-27 was nearly double that recorded in the EWCS in 2024 (21 % versus 12 %), although the category used in the ISOC – ICT professionals (that is, ISCO 25) – represents only a subset (52 % of employment in the EU-27 in 2024) of the broader category of ICT specialists (the focus of this chapter). The survey confirms a wide differential in generative AI use (36 pp) between ICT professionals (57 %) and all workers (21 %). As our colleagues who shared these data have commented, 'A clear majority of ICT professionals have incorporated generative AI into their work practices, whilst non-ICT professionals remain in early adoption stages with fewer than one in five using these tools professionally at the EU level' (Eurofound, 2026b).

Among Member States with reliable data, ICT professional adoption ranges from 42 % in Italy to 84 % in Malta. High-adoption Member States are Malta, Estonia, Finland, Lithuania and Austria, with all rates exceeding three quarters of ICT workers using generative AI tools. Even Member States with a modest overall national adoption rate demonstrate high ICT professional rates. This is the case for both Bulgaria and Poland, where a majority of ICT workers use generative AI for work purposes despite low overall national adoption rates. Germany's relatively modest ICT professional adoption (51 %) stands out as below expectations for a major EU economy. Italy's lower rate aligns with its generally low adoption performance across all categories (Eurofound, 2026b).

Figure 19: Use of generative AI for work purposes by ICT professionals (ISCO 25) (%)



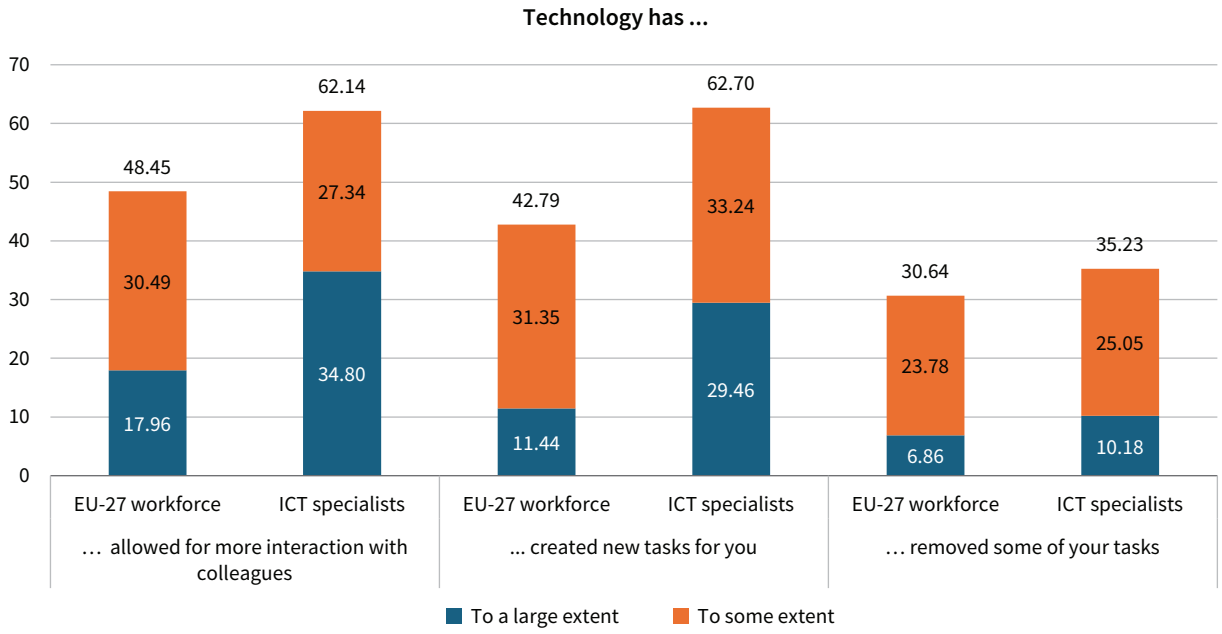
Note: One or both data points for Croatia, Greece, Hungary, Ireland and Romania were excluded due to low reliability.
Source: Eurostat ISOC (online data code: isoc_ai_iaiu) (authors' elaboration).

A final interesting finding from the ISOC data is that a higher share of EU-27 respondents report using generative AI tools for private purposes than for work purposes. The difference is marginal in the case of ICT professionals (58 % versus 57 %) and somewhat bigger for all workers (28 % versus 21 %): 'Private use consistently exceeds professional use across nearly all Member States, suggesting that workplace integration of generative AI remains in early stages and that individuals are experimenting with these tools in their personal lives at considerably higher rates than they are incorporating them into formal work' (Eurofound, 2026b).

Figure 20 confirms that the work of ICT specialists is more exposed to technology-induced disruption than that of the general workforce, particularly in terms of collaboration and job task creation. Just over 62 % of ICT specialists report that technology has allowed for more interaction with colleagues to a 'large' or to 'some' extent, compared with only about 48 % of the general workforce. Furthermore, technology is a much stronger driver of new tasks for these specialists; approximately 63 % state that technology has created new tasks for them, whereas only 43 % of the total EU-27 workforce says the same. Of note, nearly 30 % of ICT specialists report that this has happened to a 'large extent', almost triple the rate of the average EU worker (11 %).

While technology is frequently associated with automation and the removal of duties, the EWCS data suggest that for ICT specialists technology is more task additive than task reductive. While ICT specialists report a slightly higher rate of task removal (35 % versus 31 % for the EU-27 average), the gap is much narrower than in the categories of task creation and interaction. This indicates that for ICT specialists the primary role of new technology is to expand the scope of task and social connectivity of their roles, rather than automating and removing existing tasks or responsibilities.

Figure 20: Impact of technology on work, EU-27(%)



Note: Question posed is a binary yes/no question, asking respondents to indicate to 'what extent technology has impacted your work in the last three years. Please exclude minor or regular updates'.
Source: EWCS 2024 data (authors' elaboration).

Skills: training

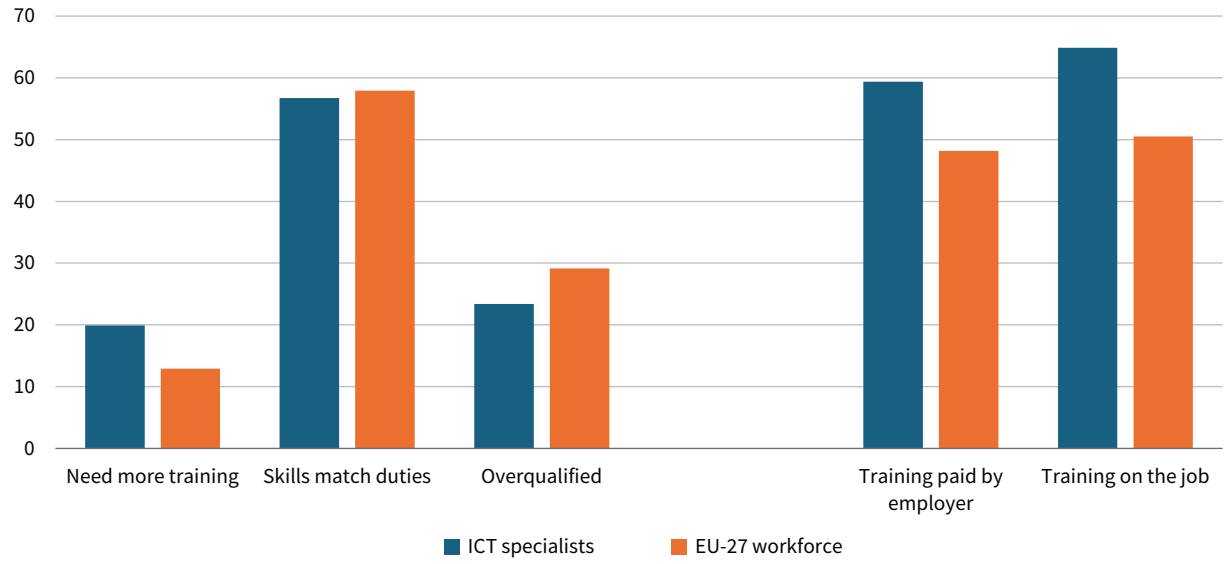
One characteristic of the IT sector is the short shelf life of specialised IT technical knowledge. While many professions are experiencing an incremental increase in digital requirements, ICT specialists operate in an environment where the core tools of their trade – including programming languages, framework architectures, security protocols, etc. – are evolving at a faster pace. Based on an index of occupational skill stability, IT occupations rank highest in terms of risk of obsolescence (Cedefop, 2016). Proficiency in a specific language or platform can be rendered outdated within a few years by the emergence of more efficient, secure or commercially successful alternatives. As a result, on-the-job, in-house and external-party training are likely to be continuous requirements. The learning process is in any case often incorporated into daily tasks, involving the steady updating of foundational knowledge and its application to new problems. This contrasts with non-ICT roles, where digital training is typically focused on the stable application of software to support specific business goals.

ICT specialists are more likely to feel they need more training than the average worker (20 % versus 13 %) (see Figure 21). Conversely, they are less likely to report being overqualified for their roles (23 % versus 29 %).

The high share reporting skills match ('your skills match well with your duties', 57 % for ICT specialists) suggests that IT roles are generally well-aligned with high skills levels, while a significant minority of ICT specialists consider themselves underskilled as new technologies emerge. Within the broader ICT specialist category, ICT professionals (ISCO 25) are more likely to report needing more training than ICT technicians (ISCO 35) (21 % versus 12 %).

ICT specialists also participate in training at higher rates than the general workforce, which suggests a culture of continuous professional development. Nearly 60 % of ICT specialists received some form of training paid for by their employer, compared with 48 % of all EU workers. These relatively high figures stand in contrast to those reported in the previous section, based on the ISOC (see Figure 14), which show that only around 22 % of employers provide ICT training. Part of the discrepancy is explained by the fact that the Eurostat ICT survey asks specifically about training to develop or upgrade ICT skills, whereas the EWCS enquires about any form of training. Moreover, the unit of analysis is different: Eurostat surveys all enterprises with 10 employees or more – only a minority of which employ ICT specialists – whereas the EWCS targets workers, and can target ICT specialists as an occupation.

Figure 21: Skills mismatch and training provision for ICT specialists, EU-27 (%)



Source: EWCS 2024 data (authors' elaboration).

In the EWCS, a high share of ICT specialists report being frustrated in their pursuit of training; 20 % of ICT specialists report not having received employer-paid training despite having requested it – nearly twice the level for the workforce as a whole (11 %). There is also a gap with regard to on-the-job training, with 65 % of ICT specialists engaging in on-the-job learning (EU-27, 51 %).

High levels of training participation are characteristic of high-performance work practices. The dominance of on-the-job training (65 %) reflects the IT sector's reliance on informal learning (see Box 4). In technical fields, most effective skill acquisition happens through learning by doing and collaborative problem-solving (Eraut, 2004; Engeström, 2015). Training in IT work is often a social, collaborative process that is integrated into the daily workflow rather than a separate formal classroom-based activity. This is consistent with earlier data indicating that, for ICT specialists in particular, technology has increased their interaction with colleagues (Figure 20).

Box 4: A national initiative on future IT skills needs – Ireland

The IT sector has been an important contributor to Ireland's economic growth over recent decades. Many of the world's largest tech companies have their Europe, Middle East and Africa (EMEA) headquarters in Ireland, mainly in and around Dublin – including Alphabet/Google and Meta/Facebook – where TikTok also has its EMEA trust and safety hub. Dublin is also one of the top data centre hubs in Europe, developed in large part to service the needs of the three big cloud computing service providers – Microsoft Azure, Google Cloud and Amazon Web Services (AWS) – all of which have their European bases there. More than 1 in 10 of the city's workers are employed in the ICT sector.

There is an awareness – and, to an extent, anxiety – among policymakers about the country's reliance on a small number of multinationals, which are estimated to generate directly or indirectly more than half of government tax revenues and as much as 88 % of corporate tax revenues (Revenue.ie, 2025). This has been heightened, since 2025, by increasing trade frictions between the United States and non-EU countries, including the EU-27, given the weight of the United States in the sector. To date, however, technology investment in the country, and the resulting employment, has been stable or expanding.

With a low unemployment rate (4.9 % in the third quarter of 2025) and shortages, in particular, in IT specialisations, Ireland's Expert Group on Future Skills Needs [5] undertook a project to investigate the skills

[5] Established in 1997, Ireland's Expert Group on Future Skills Needs is an independent, non-statutory body that includes representatives from the business community, education and training providers, trade unions and government. The group has the task of advising government on future skills requirements and associated labour market issues, and organises research to that end.

needs of the ICT sector in Ireland on a 2030 horizon ([6]). This included a series of workshops in late 2025 (including one hosted at Eurofound), an employer survey (*n* = 512) and a concluding report published in spring 2026. An important focus of the project was how to address high skills needs in two emerging IT areas: cybersecurity and AI.

The following summary of the main findings of the project is based on a draft of the final report *Digital skills for Ireland 2030*, kindly made available by the Department of Enterprise, Tourism and Employment in February 2026 (DETE, forthcoming), and notes taken by Eurofound researchers participating in workshops in October/November 2025.

Ireland's ICT workforce is projected to grow from 144 400 professionals in 2025 to between 164 000 professionals (low-growth scenario) and 184 000 professionals (high-growth scenario) by 2030. Cybersecurity is identified as the fastest-growing technology domain, with a projected 70 % increase in employment by 2030. Machine learning roles are the single fastest-growing segment. Both specialisations, however, are starting from a modest employment base, accounting together for around 10 000 of total ICT employment. Demand has shifted towards specialised, high-value roles (such as AI integration and data science), while demand for routine and entry-level tasks (like basic data entry and traditional coding) is declining owing to automation.

Organisations face challenges in recruiting for AI and cybersecurity roles owing to high competition, lack of relevant experience and high salary expectations. High costs (62 %) and the time-consuming nature of training (50 %) are frequently cited by organisations as the main barriers to upskilling.

ICT graduate numbers are growing – from 4 320 in 2018 to 7 265 in 2024 (+ 68 %) – with a shift towards postgraduate diplomas and conversion programmes, such as taught Master's degrees and higher diplomas, owing to the strong interest among non-ICT graduates in pursuing IT careers and among mid-career professionals in reskilling. Many of these courses receive funding and are heavily subsidised for students. Nevertheless, the number graduating with honours degrees has grown only modestly (+ 3 %) and the number graduating with ordinary degrees has declined (– 9 %) over the same period.

In the employer survey, a large majority of Irish organisations indicated that the expected qualifications for AI-related skills were either a doctorate/PhD (89 %) or a Master's degree / postgraduate diploma (76 %). However, only a very modest share of graduates are obtaining a PhD (85 in 2024, just over 1 % of the total), despite the huge growth in demand for doctorate-level qualifications in the rapidly growing areas of AI / machine learning: the supply of PhDs is intrinsically limited.

To put this in an EU context, the number of doctorate-level graduates in STEM subjects has been in decline across the EU; the Union of Skills communication (European Commission, 2025b) noted that of the overall decline between 2015 and 2022 (– 7 %), the most impacted discipline was ICT, where one quarter (– 25.5 %) fewer doctorates were being produced at the end of the period compared with at the beginning.

The report identifies a misalignment between educational supply and employer needs. Academic IT curricula develop at a different, slower rhythm to IT technologies. Therefore, graduates emerge with skills already obsolete. In addition, as academic salaries cannot match those in industry, universities can struggle to match industry levels of expertise. These lags are more obvious in emerging technologies, where new tools develop rapidly.

Cybersecurity, for example, tends to be included as an elective subject in degree courses with an emphasis on traditional network security. Industry, meanwhile, has moved on and is focusing on newer threats, cloud architecture, zero trust models and new AI-enabled cyberattacks. Unlike AI, the main expected qualifications for cybersecurity experts were third-party training certifications (like AWS Solutions Architect) or prior hands-on experience, rather than postgraduate academic qualifications.

Employers in the survey expressed a need for curricula that are better aligned with real-world developments and more internships for students, even though, for many, the 'perceived effectiveness [of apprenticeships] remains modest'.

A recurring motif in the workshops was the importance of 'foundational skills', that is, being able to communicate clearly, work well with other people and in teams, and be adaptive and ready to learn. While pure technical skills are in high demand, ICT specialists are increasingly required to have detailed domain knowledge, including regulatory knowledge – especially in highly data-sensitive sectors such as financial services, health and public

([6]) This project was supported by the Department of Enterprise, Tourism and Employment and external contractor IDC Europe.

administration – as well as technical IT expertise, and to be in a position to bridge all three for different audiences within the same organisation and externally.

Employers expressed frustrations with the level of practical and communications skills and the work readiness of graduates with relevant degrees. At the same time, organisations are eliminating entry-level roles where graduates can gain experience. Junior roles are disappearing as automation handles routine tasks. This risks a 'pipeline crisis' for future senior IT professionals: 'Companies want experienced hires but don't create environments where experience is built, externalising training costs to other[s]' (DETE, forthcoming).

According to a Eurofound questionnaire based on IT clusters, a sharp regional divide can be seen in Ireland. The IT labour market is 'thicker' in and around the capital city: 58 % of Dublin-based respondents reported 'good' or 'excellent' talent availability compared with just 21 % of respondents based outside the capital.

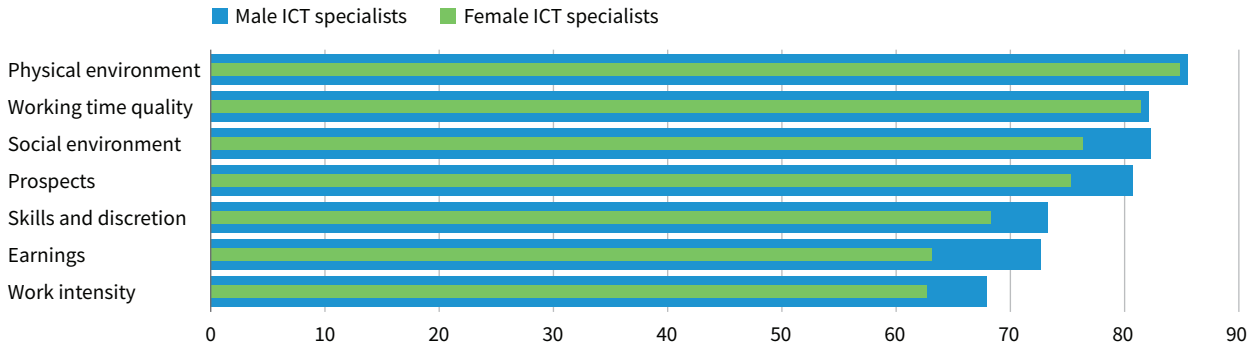
While there have been improvements, women remain under-represented in ICT, accounting for 28 % of ICT graduates and approximately 24 % of ICT specialists in Ireland. However, although Ireland has a generally younger workforce profile than other Member States, a significant portion of the Irish ICT workforce is moving into mid- to late-career stages, leading to projected retirement rates of 1.9–3.0 % annually, which will further increase replacement demand.

Finally, Ireland remains very dependent on non-EU talent for advanced IT roles. The critical skills employment permit scheme ([7]) allows non-EU applicants with an employment offer to take it up if they have relevant qualifications and the occupation is on a labour shortage list. Employers in the information and communication sector and in the health sector use the scheme the most and many ICT specialist occupations are on the critical skills list. While employment permit volumes have normalised after a post-COVID-19 pandemic surge (from c. 10 800 permits issued in the information and communication sector in 2022 to 3 600 in 2025), the scheme remains an important inflow mechanism for highly skilled IT roles. Consistently, the two IT-related occupational categories with most permits issued in recent years have been those of 'programmers and software development professionals' and 'IT business analysts, architects and systems developers' ([8]). These account for just over half (53 %) of IT-related permits issued in 2024, when Google and Amazon ranked first and third in the list of companies that were issued permits.

Gender gaps in job quality and pay

The EWCS 2024 data reveal important differences in job quality when comparing female ICT specialists with their male counterparts. In particular, the scores indicate that female ICT specialists experience lower Earnings, higher Work intensity, lower Skills and discretion and Prospects, and a harsher Social environment, but rank similarly to their male counterparts on Working time quality and the Physical environment (Figure 22). Box 5 looks specifically at the gender pay gaps in ICT.

Figure 22: Job quality of ICT specialists, by gender, EU-27



Note: All job quality indices are ranked between 0 and 100, with 0 being the lowest and 100 the highest. All dimensions are recoded so that higher scores reflect better job quality (that is, higher scores on work intensity dimensions are positive / indicate lower work intensity).
Source: EWCS 2024 data (authors' elaboration).

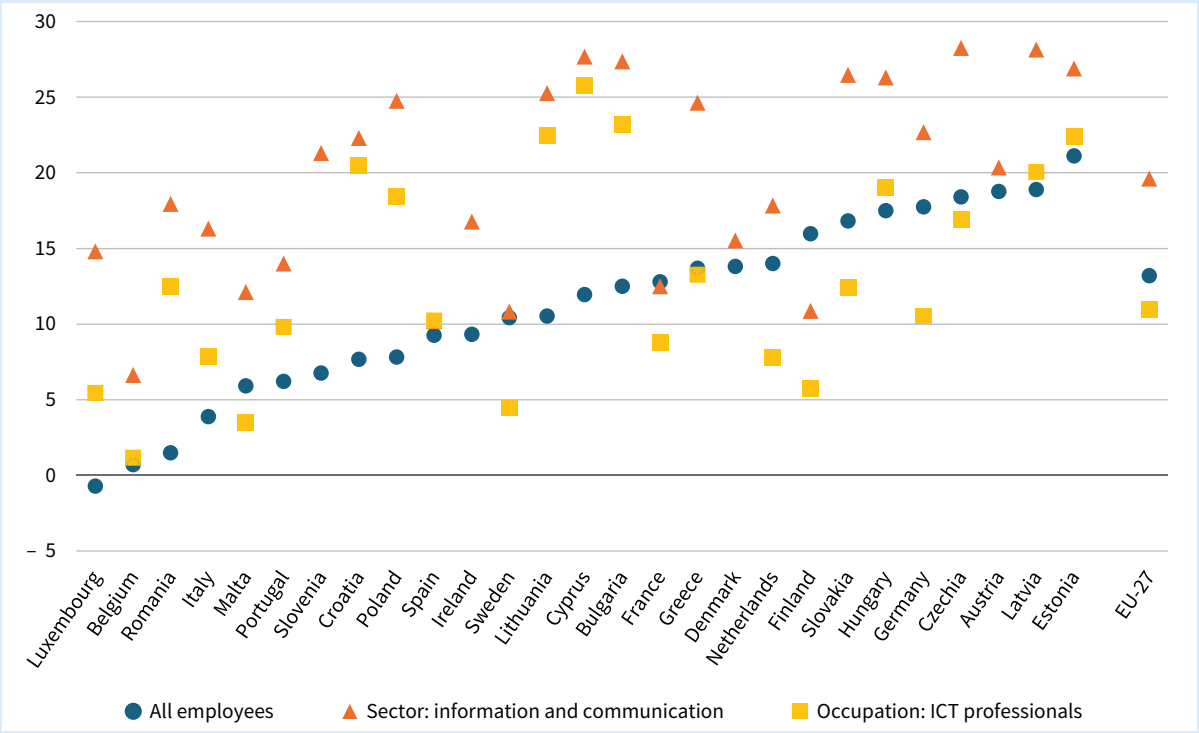
([7]) https://enterprise.gov.ie/en/what-we-do/workplace-and-skills/employment-permits/permit-types/critical-skills-employment-permit/.

([8]) Ireland's Expert Group on Future Skills Needs' report uses the UK Standard Occupational Classification rather than ISCO. These two categories would be categorised under ISCO 25, 'ICT professionals'.

Box 5: Gender pay gaps in IT

In relation to earnings, the gender pay gap is a reflection of the different economic rewards/returns that men and women receive for similar work. The level of detail in the SES does not allow us to assess the gender pay gap for our main focus – ICT specialists – but Figure 23 characterises it for the information and communication sector and the main ICT specialist occupational category (ICT professionals, ISCO 25).

Figure 23: Gender pay gaps, EU-27, 2022 (%)



Note: Member States are ranked by gender pay gap for all employees. Data are not available for ICT professionals for Austria, Denmark, Ireland and Slovenia. The EU estimate for ICT professionals is the weighted average for 23 Member States (that is, excluding these four countries) (see Annex 2 for technical details).
Source: SES 2022 data (authors' elaboration) (values for all employees and NACE Section J (information and communication sector) are from data published by Eurostat (online data code: earn_ses22_13); estimates for the occupation of ICT professionals (ISCO 25) are from authors' calculations using 2022 SES microdata).

In 2022, the most recent year for which we have detailed SES earnings data, gender pay gaps at the national level ranged from very modestly negative in Luxembourg (where women on average earn 0.7 % more per hour than men) to more than 20 % in Estonia, with the EU average gap estimated at 13.2 % (13.0 % in 2023).

The most prominent pattern is that the gender pay gap in the information and communication sector is significantly larger than the national average for all employees in almost every Member State. For the EU, the sectoral gap stands at 19.6 %, compared with 13.2 % for all employees. In Member States with small pay gaps overall, like Italy and Romania, or gaps overall that are below the EU average (for example, Croatia and Poland), the sectoral gender pay gap is often several times greater than the national average.

Restricting our focus to ICT professionals specifically, the gap tends to narrow. For the EU average, the gender pay gap for ICT professionals is 11 %. This suggests that, while the sector (which comprises a variety of occupational roles, including administrative, sales and support roles, but also broader coverage, including media and telecommunications activities) has a high pay disparity, the specific high-skilled occupation of ICT professional is somewhat more equitable.

In many eastern European and Baltic states, the sectoral gender pay gap is especially large; for example, it is 28 % in Cyprus, Czechia and Latvia, indicative of high gender–wage stratification and segregation that is both vertical, with poorer access to senior professional or management roles for women, and horizontal, with the concentration

of women in lower-paying activities. Interestingly, the largest pay gaps occur in both Member States with low female representation in IT (for example, Czechia) and Member States with high and fast-growing female representation (for example, Estonia and Latvia). More detailed data would be needed to identify what the contribution of the core IT sector (NACE 62) is to these large gaps. Gender pay gaps are more modest for ICT professionals, although even still around half of Member States show larger-than-average gender pay gaps. The smallest occupational gaps are observed in Nordic Member States and in Belgium, Luxembourg, Malta and the Netherlands, while larger gaps are observed in CEE Member States.

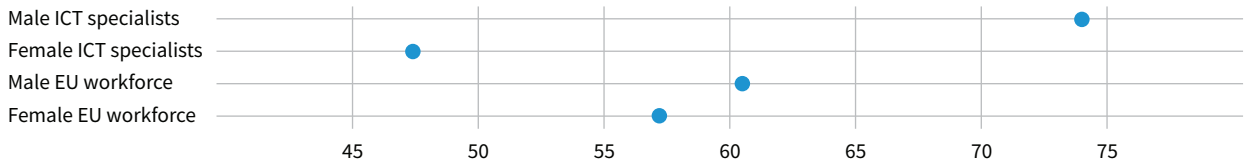
According to EWCS 2024 data and other sources (Eurofound, 2026b), generative AI take-up has been faster among male IT employees than female employees. Recent US research (Tambe et al., 2025) identifies both a lower likelihood that women are assigned to or apply for roles in these emerging specialisations and a 6 % wage premium for such roles. One consequence, given the huge investment in AI and related newer technologies (including cloud computing and cybersecurity), could be a widening gender pay gap and gender segregation among ICT specialists.

In what follows, we examine the five job quality indices where the differences in job quality between female and male ICT specialists are the highest according to EWCS data and identify the job characteristics contributing to these job quality gaps. For each of the five job quality indices selected, the gender differences in the job quality indices identified were statistically significant at the $p = 0.05$ level in multivariate analysis ([9]).

Considering **Earnings** first, in addition to differences in pay levels, women in ICT occupations report more predictability in their earnings than their male counterparts (5 pp difference), although in part this may relate to the greater likelihood of men earning performance-related bonuses than women (44 % versus 37 %). There is a strong gender divergence in perceptions of the fairness of pay in relation to their earnings: 47 % of female ICT specialists agree that they are paid fairly in relation to their efforts (27 pp less than their male counterparts). This is also 10 pp lower than the EU average for women. Male ICT specialists are therefore more likely than other male employees to strongly agree or tend to agree that they are paid appropriately ('considering all [their] efforts and achievements in [their] job'), while the opposite is the case for female ICT specialists, who are less likely than other female employees to strongly agree or tend to agree that they are paid appropriately (Figure 24).

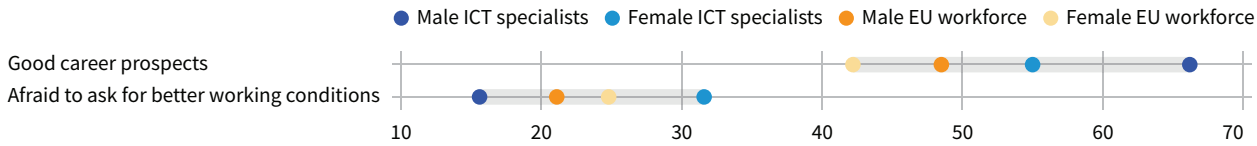
When **Prospects** are considered, women in ICT occupations report similar levels of job insecurity (likelihood of job loss in the next six months) (+ 1 pp) and qualitative insecurity ('expecting an undesirable change in [their] work situation') (+ 3 pp). Differences are most significant in relation to career prospects and fear of asking for better working conditions (see Figure 25).

Figure 24: Whether workers are fairly paid in relation to efforts, ICT specialists, EU-27 (%)



Source: EWCS 2024.

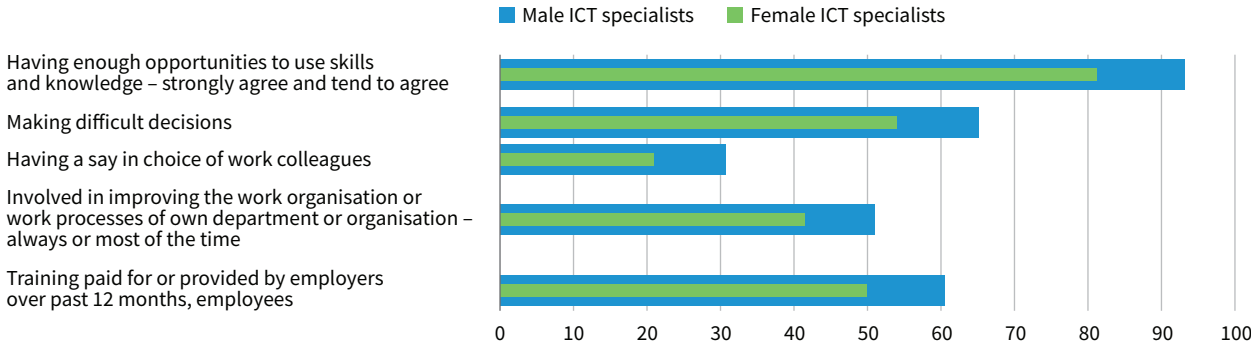
Figure 25: Career prospects and capacity to alter working conditions, EU-27 (%)



Source: EWCS 2024 data (authors' elaboration).

([9]) Notwithstanding the relatively small size of the subsample of ICT specialists ($n = 1\,221$) and its gender skew (female $n = 260$, male $n = 961$), both simple linear regressions and propensity score matching analysis were carried out, where, in addition to gender, controls were included for part-time work (binary), professional/managerial status (ISCO 1 or 2, binary), workplace size (four categories) and tenure in current job (four categories).

Figure 26: Skills and discretion – items with highest gender gaps between male and female ICT specialists, EU-27 (%)



Source: Authors, based on EWCS 2024 data.

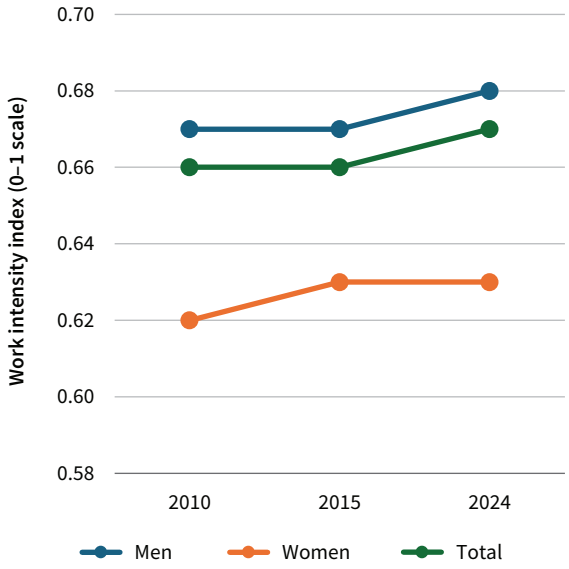
Female ICT specialists are less likely to report having good career prospects than their male counterparts, although women in the sector generally report better prospects than the average European worker. They also report being more fearful to ask for better working conditions, compared with both their male counterparts and the working population as a whole.

While female ICT specialists fare more poorly than their male counterparts on most items under the **Skills and discretion** dimension, their job quality is around 10 pp lower in items indicated in Figure 26, with divergences biggest in relation to 'involvement in improving the work organisation or work processes of their own department or organisation'. They are also less likely to report having had employer-provided training over the previous 12 months.

Other recent research demonstrates that gender gaps in advanced digital skill use persist even after controlling for education, occupation and sector (Whelan et al., 2026). This suggests that other gender differences are at play – for example, in task allocation, career progression barriers or unequal access or uptake in upskilling in emerging specialisations. In each case, the focus turns away from individual aptitudes or qualifications towards questions regarding the working/organisational environment and task allocation practices within IT roles and organisations that may be having a negative impact on female ICT specialists.

Gender differences in the **Work intensity** index are driven mostly by a higher level of work demands for women than for men: in 2024, 41 % of women in ICT occupations reported working to tight deadlines at least three quarters of the time (EU-27, 35 %). Gender differences in the Work intensity dimension are also persistent over time (see Figure 27), with female ICT specialists consistently recording lower values (signifying higher work intensity) over the last three major editions of the EWCS.

Figure 27: Work intensity index by gender for ICT specialists, EU-27, 2010–2024

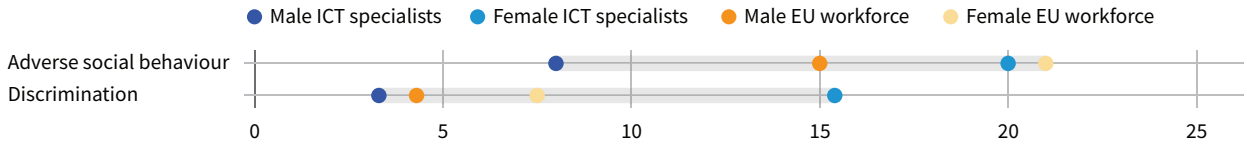


Source: Authors, based on EWCS 2010–2024 data.

Beyond immediate workload, these differences may increase stress and work–life conflict, limit opportunities for skills development and innovation and reduce career progression if high effort is not matched by visibility or reward. When combined with gendered access to emerging high-growth IT roles, noted in Box 5, this pattern risks reinforcing structural inequalities in pay and career trajectories.

The final job quality index considered is that of **Social environment**. Women in ICT occupations report a higher prevalence of adverse social behaviours and of discrimination at work than their male counterparts (Figure 28).

Figure 28: Social environment – adverse social behaviour and discrimination at work, EU-27 (%)



Source: Authors, based on EWCS 2024 data.

Some 1 in 5 female ICT specialists in the EU-27 (20 %) has experienced at least one form of adverse social behaviour, compared with 8 % of their male counterparts, while around 15 % report being discriminated against, compared with 3 % of their male counterparts. The adverse social behaviours to which female ICT specialists are most exposed are bullying and cyberbullying, with relatively low exposure to unwanted sexual behaviour or sexual harassment (compared with other female workers).

In summary, according to EWCS data, ICT specialists in the EU-27 enjoy better-than-average job quality across the seven dimensions covered by Eurofound's job quality framework, with notably high scores on the Earnings and Skills and discretion dimensions. There is, however, a marked difference by gender. For example, female ICT specialists are paid less than their male counterparts, are much less likely to consider themselves fairly paid in respect of their work effort and are exposed to higher levels of work intensity and adverse social behaviours. These aspects of work culture may be discouraging women from taking up jobs in the sector.

ICT specialists make intensive use of digital technologies and have been early adopters of generative AI. EWCS survey data from 2024 and 2025 show that they were between three and four times more likely to be using generative AI in their work than the average worker. Despite higher qualification levels and better access to paid training, ICT specialists are nearly twice as likely to report needing more training to do their jobs than the average worker, reflecting the rapidity of development of digital technologies.

3 Managing change and restructuring in IT

The technology sector has achieved steady employment growth over the past decade. It also experienced an unusual wave of global restructurings in 2022, taking place especially in US 'big tech' multinationals (Eurofound, 2023, 2025). This chapter documents the timing and impact of restructuring events in the ICT manufacturing and services sectors using data from the ERM. It also shows the more common types of career transitions around the technology industry.

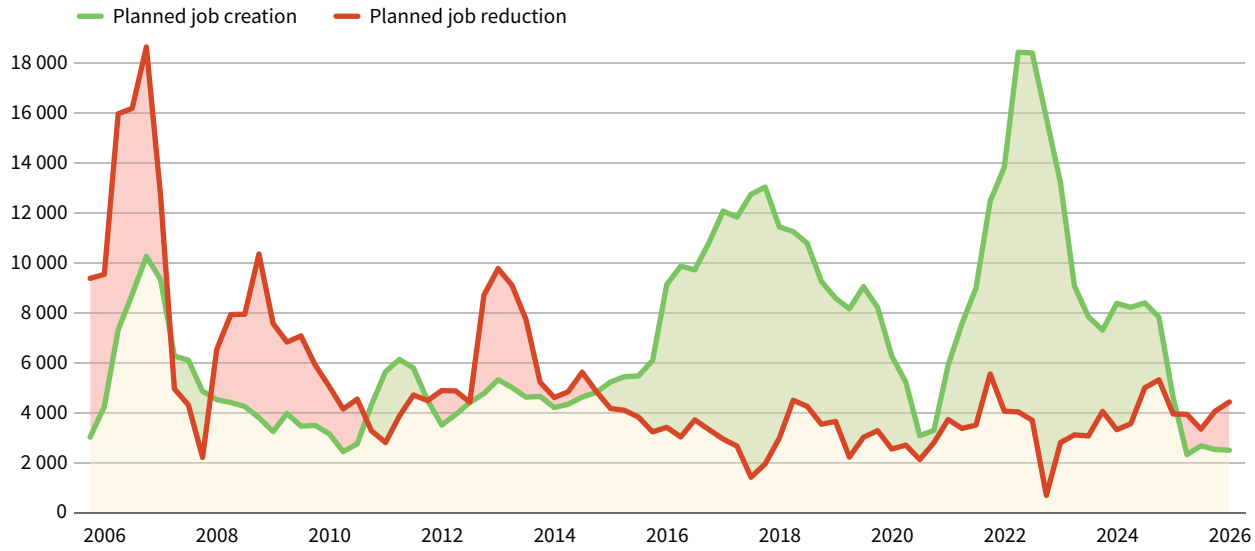
Restructuring in ICT manufacturing and services sectors

The ERM, managed by Eurofound, has been tracking large-scale restructuring event announcements – such as collective redundancies, large-scale hiring, closures, bankruptcies, relocation, offshoring and reshoring – through media reports and company announcements, since 2002. This chapter analyses ERM data from 2005 to January 2026 ([10]). The analysis starts in 2005, as it is the year when the database began tracking business expansions alongside job losses or redundancy categories.

This section includes data from restructuring announcements in the ICT sector, in both **ICT manufacturing** (NACE 26.1–26.4 and 26.7, spanning the manufacture of electronic components and boards, computers and peripheral equipment, communication equipment, consumer electronics, and magnetic and optical media) and **ICT services** (NACE 46.5, 58.2, 61–63 and 95.1, spanning the wholesale of integrated circuit equipment, software publishing, telecommunications, computer programming and consultancy, data processing, hosting, web portals and repair of IT equipment), as defined by Eurostat (see Annex 1). In addition, the analysis includes all restructuring occurring in other sectors, where at least one ICT specialist was mentioned to be hired or made redundant. The full list of job titles related to ICT specialists included for this screening is reported in Annex 1.

Since 2005, the announcements in the ICT sector and the announcements involving ICT specialists have related to a high level of restructuring activity (Figure 29).

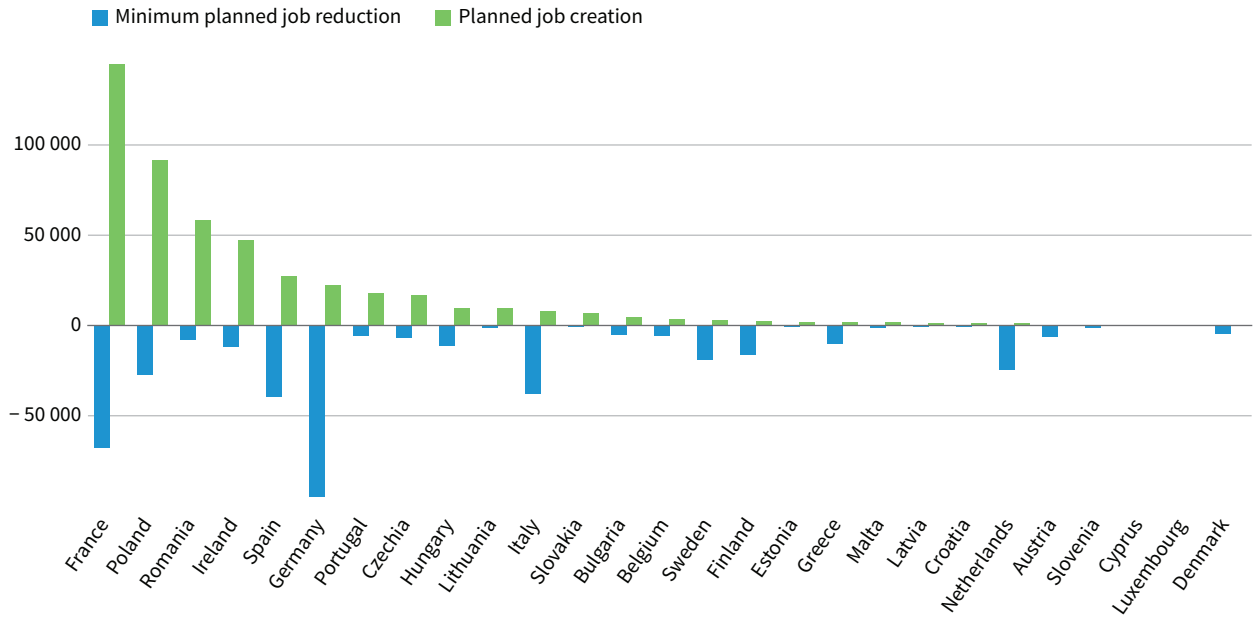
Figure 29: Announced employment effects in the ICT sector and occupations, four-month moving average, EU-27, 2005–Q1 2026



Note: ICT sector includes the following NACE sectors: 26.1–26.4, 26.7, 46.5, 58.2, 61–63 and 95.1. In addition, it includes all restructuring in other sectors where at least one IT professional was hired or made redundant. The full list of occupations considered as IT professionals is in Annex 1.
Source: Authors, based on ERM data.

([10]) ERM data were extracted on 10 February 2026.

Figure 30: Announced employment effects of restructuring in ICT services by Member State, 2005–2025



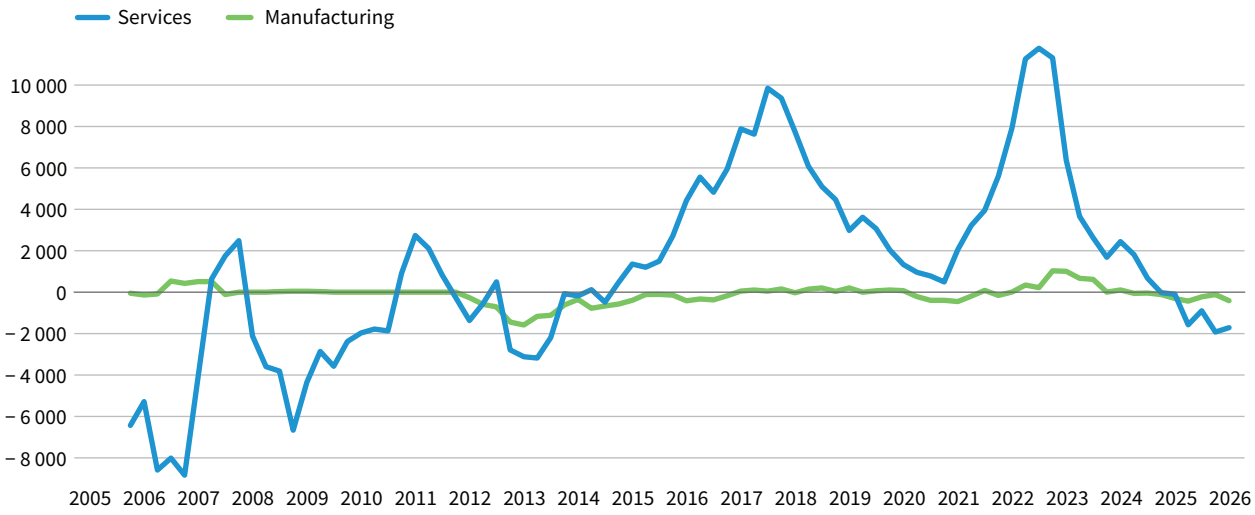
Note: The data include only national announcements. The following NACE sectors are included: 46.5, 58.2, 61–63 and 95.1.
Source: Authors, based on ERM data.

The majority of restructuring announcements have come from companies offering IT services, representing 8.5 % of all the national cases in the database. The number of announcements in the IT manufacturing sector is more limited (0.7 %). Outside the IT sector, IT professionals as an occupational group are mainly mentioned in business expansion announcements.

Owing to the high level of restructuring activity, IT services have recorded the highest levels of both job creation and job losses. Over the past 20 years, France, Poland, Romania and Ireland have seen the most substantial job creation announcements within the IT services. In contrast, Germany, France, Italy and Spain have reported the largest aggregate employment losses. Notably, although France appears in both groups, the overall net impact there has been positive (Figure 30).

IT services restructuring developments over time can be divided into two periods: before 2015, when the net employment change, according to job and redundancy announcements, was mainly negative, and after 2015, since when the balance has been positive. The initial negative balance until 2015 was driven exclusively by extremely large collective redundancies of telecom companies, which are part of the IT services according to Eurostat's classification, as already noted. In this period, Deutsche Telekom announced the redundancy of 26 000 employees (in 2006), while France Télécom announced the redundancy of 16 000 employees (in 2009). These two cases represent the largest redundancies recorded over the entire period (2005–2025). However, over time, the trend changed as the subsector NACE 62 – computer programming, consultancy and related activities – announced increasing hiring (Figure 31).

Figure 31: Announced net employment effects of restructuring in IT services and IT manufacturing, four-month moving average, EU-27, 2005–2025

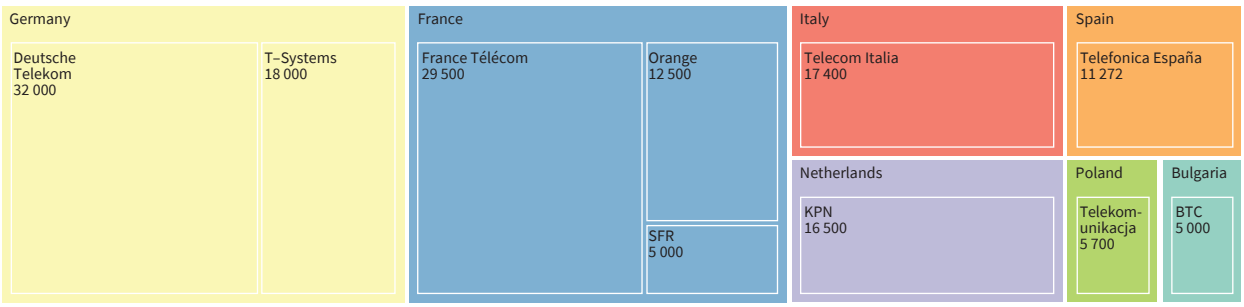


Note: The data include only national announcements. IT manufacturing includes NACE 26.1–26.4 and 26.7; IT services include NACE 46.5, 58.2, 61–63 and 95.1.
Source: Authors, based on ERM data.

In the net positive part of the trend, after 2015, two major waves of hiring took place: the first between 2014 and 2017, when cloud technologies expanded, and the second during the COVID-19 period, between 2020 and mid-2022, when the shift to telework and restricted mobility significantly increased the use of digital services. In the former period, the telecom sector continued to cut jobs via restructuring (see Figure 32), while tech consultancy expanded. During this time, the French consultancy Alten recorded the largest number of new hires: 2 500 employees in 2015 and 3 000 in 2017, both in France. Other major recruiters in this period included the French IT consultancies CGI (2 500 hires) and Sopra Steria (2 300 hires), and Accenture in Spain (2 000 hires).

Between 2005 and January 2026, although the scale of restructuring in IT manufacturing (195 cases) ([11]) was considerably smaller than in IT services (2 115 cases), almost every Member State (24 out of 27 Member States) experienced at least one restructuring announcement. Over this period, the largest cumulative job losses in IT manufacturing were recorded in Germany (10 547), followed by France (3 595) and Czechia (3 179). The single largest redundancy event occurred in January 2026, when Ericsson announced plans to make 1 600 employees in Sweden redundant – more than a tenth of its national workforce. According to the company, the measure formed part of a global effort to improve its cost structure and strengthen competitiveness amid low market growth and rising inflation-related costs (Figure 33).

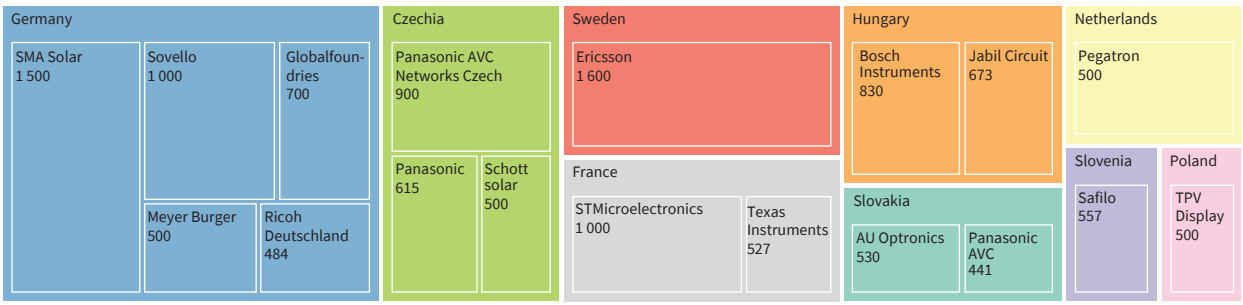
Figure 32: Largest companies by total job redundancies at the national level in ICT services, EU-27, 2005–2025



Note: If the same company had multiple restructurings, the sum of employment losses is shown.
Source: Authors, based on ERM data.

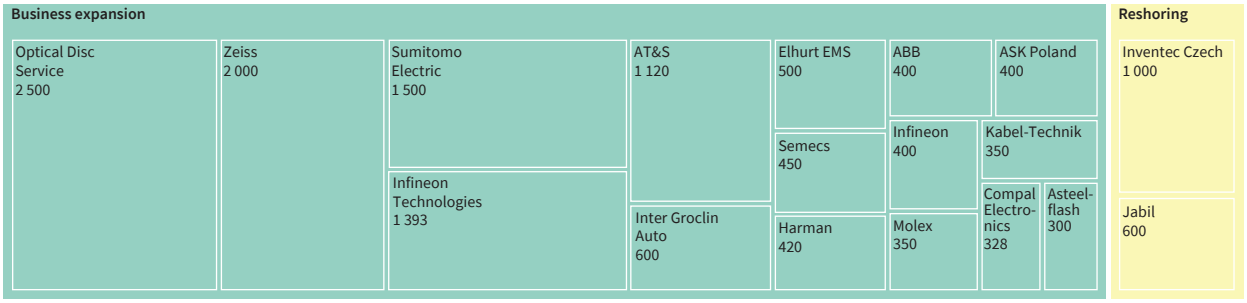
([11]) IT manufacturing includes the manufacture of electronic components, computers and peripheral equipment, communication equipment, consumer electronics and optical instruments, magnetic and optical media and photographic equipment.

Figure 33: Largest cases of redundancies at the national level in ICT manufacturing, EU-27, 2005–2025



Source: Authors, based on ERM data.

Figure 34: Largest cases of job creation at the national level in IT manufacturing by restructuring type, EU-27, 2002–2025

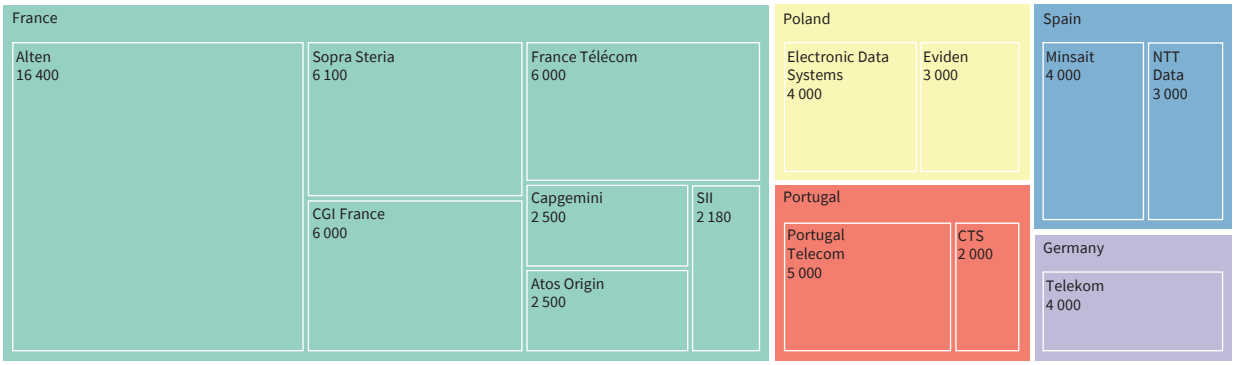


Source: Authors, based on ERM data.

In contrast, the highest levels of job creation in IT manufacturing during the same period were reported in Poland (6 798), Austria (2 895) and Germany (2 640), highlighting significant variation in employment dynamics across the EU. One of the largest recent announcements was on 14 December 2022, when the German optics group ZEISS announced the creation of 2 000 new jobs in Germany. Together with its partners, the laser specialist TRUMPF and the Dutch manufacturer ASML, ZEISS equips chip factories with lithography systems. The increased demand for semiconductors has been contributing to the expansion of these companies (Figure 34).

Although several tech companies announced redundancies in the first months of the COVID-19 crisis, business expansion resumed quickly. Between 2020 and mid-2022, IT consultancy and digitalisation services experienced a peak in hiring demand. Minsait, a Spanish company specialising in digital transformation and IT consultancy in Spain and Latin America, hired 4 000 employees, while Sopra Steria recruited 3 800 consultants, developers, data analysts, business analysts and cloud experts (Figure 35).

Figure 35: Largest companies by total job creation at the national level in IT services, EU-27



Source: Authors, based on ERM data.

This period also saw a significant number of transnational restructurings. Facebook announced that 10 000 jobs were to be created in France, Germany, Ireland, Italy, the Netherlands, Poland and Spain to support the development of its virtual reality 'metaverse'. Capgemini, the French management and consultancy company, which offers technology advice and services to companies, announced the recruitment of 4 450 full-time employees in addition to nearly 900 trainees and 850 young people on a work–study basis in France, Germany and Spain. In addition, each of the US big tech companies announced revised growth strategies, with significant increases in their headcount to match forecasted expansion due to the rapidly increasing demand for their respective products and services at the time (see Box 6).

Box 6: Restructuring at IBM in Europe

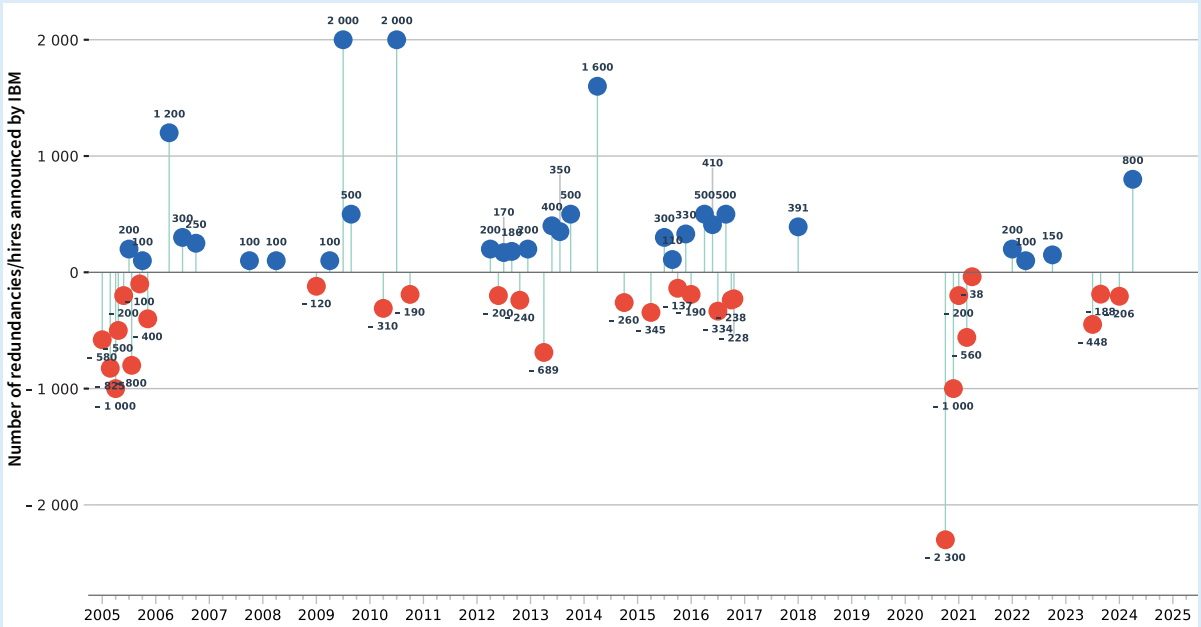
IBM, the global multinational tech company headquartered in New York, is the IT company that has recorded the largest number of announcements since 2005. The significant number of announcements, 59 in 20 years, tells a story of how the company has evolved and moved its services across Europe and the world over time (Figure 36).

Around 2005, most redundancies occurred in western Europe, particularly in Belgium, Germany, the Netherlands and Sweden, while a number of job expansions in the following years took place eastward, especially in Czechia, Hungary and Poland. The one notable exception to this eastward trend was a series of business expansions in Ireland.

By around 2010, another round of redundancies had taken place as production had been offshored to China and Singapore. The high-end server manufacturing operations based in Dublin were moved to Singapore in order to be closer to expanding Asian markets.

Between 2012 and 2014, western Europe experienced yet another wave of job cuts, especially in France and Italy, while Poland, Romania and Slovakia saw job expansion announcements during the same period. An interesting exception is the opening of a services centre in the Netherlands as the outcome of a partnership with the province and municipality of Groningen, the Hanze University of Applied Sciences Groningen, the University of Groningen and the University Medical Center Groningen, aiming to provide a solution to the expected shortage of ICT specialists and the opportunity for hands-on practice to recent graduates.

Figure 36: IBM restructuring announcements in the ERM, 2005–2025



Source: Authors, based on ERM data.

In 2016, IBM opened the Client Innovation Centre in Croatia to provide technical support services to users worldwide 24 hours a day and in the languages of countries using the IBM system. The IBM centre also collaborates with Croatian universities in creating mentoring programmes designed to prepare young people for work at the centre. That same year, restructuring efforts resurfaced, this time in Belgium, Italy and the Netherlands, as companies shifted additional functions to India.

In 2023, the IT wave of redundancies also affected eastern Europe, with a redundancy in Slovakia and one offshoring from Hungary to Mexico. The final expansion captured in the database was, once again, in Ireland, focused on building advanced software capabilities in AI, particularly in security, automation and cloud computing. Currently, IBM has more than 300 000 employees across more than 170 countries.

This rapid increase was then followed by a significant wave of announcements of large job losses starting in November 2022 and making news headlines for months. Microsoft and Salesforce recorded lower demand as consumer behaviour changed, while Google and Meta (the parent company of Facebook, Instagram and WhatsApp) recorded a slowdown in advertising revenue, which led to pressure to cut costs. Many clients and contractors connected to these big companies also experienced a significant impact; the ICT sector recorded its highest number of job losses in a collective redundancy during this period.

2024 was a more mixed year, with three big tech companies announcing redundancies in the first half of the year: Meta, Salesforce and Microsoft. In the second half of the year, Microsoft announced three business expansions (in Ireland, Romania and Spain), while Amazon announced job reductions. Most significantly, the number of jobs cut in the 2024 big tech redundancies was much smaller in scale than the redundancies that took place in 2023. In addition, the redundancies from these companies were carried out more often at the national level rather than at the international level. Also, outside the big tech companies, restructuring activity was more mixed in its effects, with job losses and job hiring taking place.

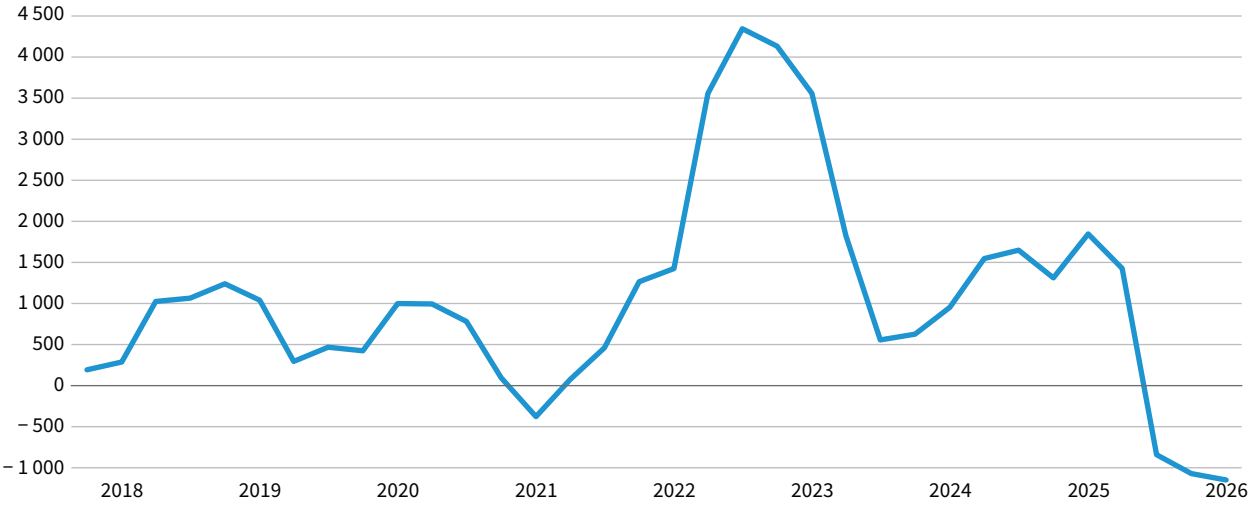
In 2025, the technology sector faced another significant wave of layoffs, driven by broad restructuring strategies and a shift in investment priorities, particularly towards AI (Figure 37). Across the industry, companies framed these reductions not simply as cost-cutting measures but as part of a deeper organisational transformation.

Amazon announced 14 000 corporate job cuts worldwide, indicating that the decision aimed to streamline operations, reduce bureaucracy and reallocate resources towards its highest internal priorities. The impact was felt strongly in Spain, where Amazon Digital Spain and Amazon Spain Services announced 1 200 proposed redundancies, later reduced to 920 following negotiations with employee representatives.

Meta also announced 3 600 job cuts globally, although the specific effects on European operations remained unclear. In contrast, the distribution of Microsoft's 9 000 global layoffs was clearer. While most layoffs were concentrated in the United States, Europe experienced notable, but smaller, reductions: approximately 200 jobs were cut in France, 240 in Ireland and 138 in Romania. The announcement sparked considerable anger among French employees, particularly as Microsoft simultaneously highlighted an additional USD 80 billion investment plan linked to the expansion of its AI-driven activities.

Salesforce undertook two rounds of workforce reductions during the year, cutting 1 000 jobs in February and an additional 4 000 in September. According to Chief Executive Officer Marc Benioff, these measures formed part of the company's transition towards becoming an 'agentic enterprise', a model in which resources are increasingly redirected to sales and high-growth areas while AI replaces functions previously performed by human agents. Taken together, these companies simultaneously reduced headcount and accelerated investment in strategic growth areas – particularly AI – reshaping both their business models and the distribution of employment across Europe and beyond.

Figure 37: Announced net employment effects of restructuring mentioning AI, four-month moving average, EU-27, 2017–2026



Note: All job losses/gains in cases where AI is mentioned in the case narrative are included in the chart, even if AI was only one contributing factor to the employment effects noted. The data include only national restructuring announcements.
Source: Authors, based on ERM data.

A possible future expectation is that AI will create another large wave of restructuring. However, the ERM provides little evidence that this is happening. Currently, AI and large language models are a marginal phenomenon among the reasons for large restructurings cited in ERM cases, amounting to only 164 restructurings in a dataset that has more than 32 000 restructurings ([12]). However, while AI and large language models have been mentioned mostly in relation to job creation cases up to 2024, in 2025 they started appearing in cases of job reduction. From the announcement, however, it is unclear if the redundancies have taken place because of AI adoption or if AI was used as a pretext or to avoid having to disclose other types of problems in the company, such as financial problems or mismanagement. Ireland offers an interesting case study of recent restructuring trends in the IT sector (Box 7).

Box 7: Hiring and restructuring cycles in IT – the case of Ireland

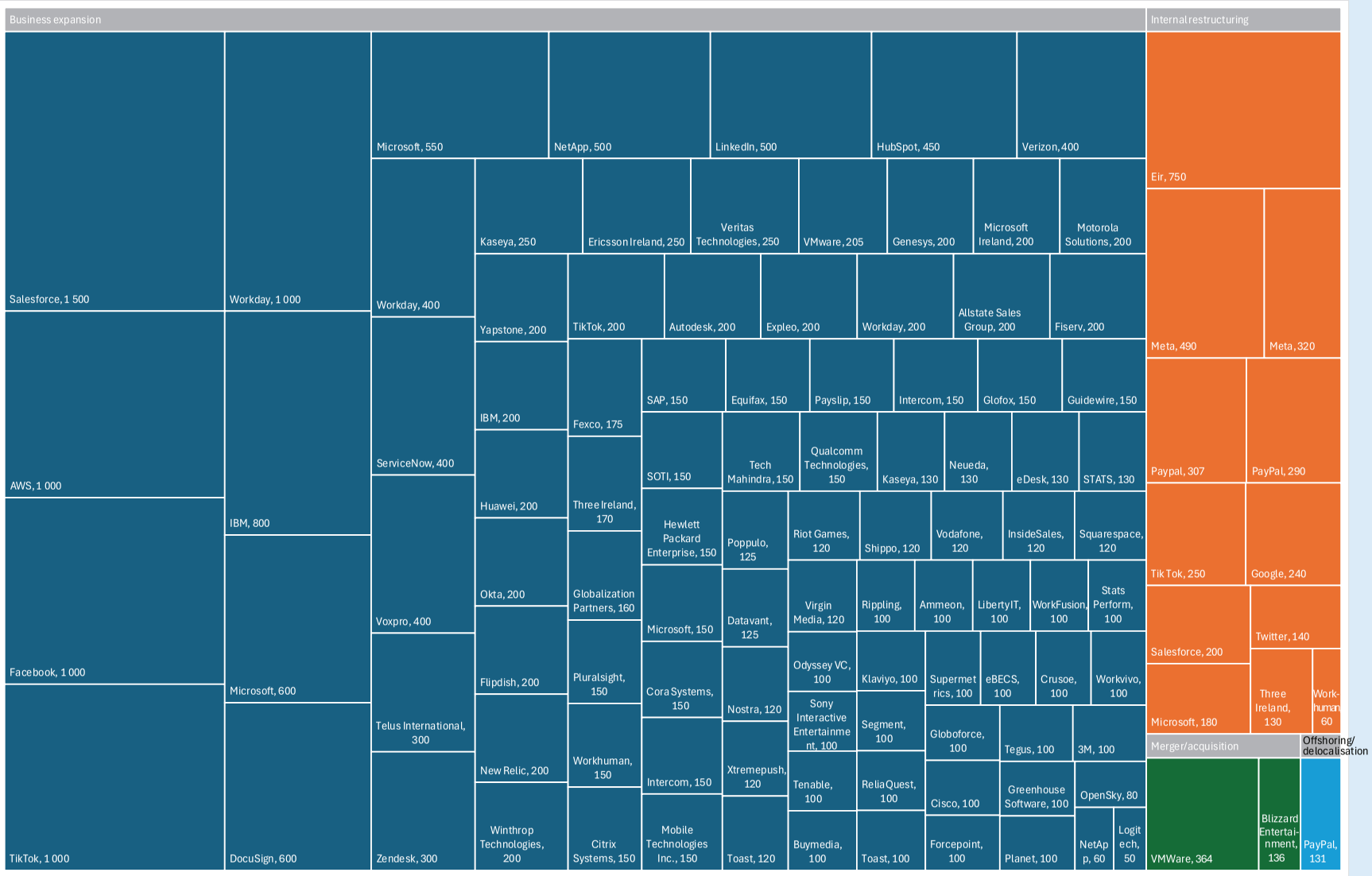
Ireland has the sixth-highest share of IT employment in the EU, at around 6 %, and it hosts the European headquarters of several US IT multinationals, which may make it more prone to large restructuring events. The ICT sector in Ireland has experienced strong employment growth in the past few decades, but since 2022 the media has also reported relatively large rounds of layoffs in multinationals.

Data on restructuring from the ERM events database, combined with hiring data from LinkedIn, describe in detail the recent dynamics of hiring and restructuring in Irish IT, showing its cyclical nature.

Summing up the employment effects of restructuring events in the Irish ICT sector – mostly ICT services, but also some ICT manufacturing – shows that, since 2017, large job gains have outweighed job losses. Overall, the database tracked 115 distinct restructuring events, totalling 23 350 jobs gained through business expansion. At least 3 988 jobs were lost over the same period. (The figure is conservative, as it only includes the jobs that were explicitly reported being lost in Ireland as part of multinational restructuring events.) Among these, we count 3 357 jobs lost due to internal restructuring (namely collective redundancies), 500 due to mergers and acquisitions, and only 131 to offshoring and delocalisation (Figure 38).

([12]) The cases have been included if any of these keywords appeared in the description: AI, artificial intelligence, machine learning, ML, language model, deep learning, LLM, generative AI, neural network or big data.

Figure 38: Restructuring events in the IT sector in Ireland since 2017



Source: Authors, based on ERM data.

However, some of the largest mass job creation events have occurred fairly recently, from 2019 to mid-2022, and were followed by large layoffs shortly after in the same year. In January 2019, the US business software company Salesforce announced the creation of 1 500 jobs at its Irish offices. A few days later, Meta (called Facebook at the time) added 1 000 positions in Ireland. In the first two quarters of 2022, Workday (a US software company specialising in financial and human resources software) and the Chinese social media company TikTok announced mass hiring for 1 000 jobs each – among the largest single hiring events in Ireland since 2017. The Swedish telecommunications company Ericsson also announced it was adding another 250 employees to its workforce.

However, by the end of 2022, several rounds of layoffs had occurred in the ICT sector in Ireland, mostly concentrated in US big tech companies, some of which had been expanding until a couple of years earlier: Meta announced 320 job losses in Ireland in November 2022, followed by another 490 job losses in May 2023. February 2023 saw layoffs announcements from other IT multinationals: Salesforce announced a reduction of 200 jobs, Google 240 jobs, Microsoft 180 jobs and TikTok another 250 jobs.

What did these large restructuring events entail for the employment trends in the broader Irish IT sector? To create a more complete picture, it is helpful to combine data from the ERM – which focus on large-scale restructuring events, mostly involving 100 employees or more at a time – with data derived from individual workers in the IT sector.

LinkedIn, the professional social network company, provided aggregated statistics on new job starts in the IT sector. The LinkedIn hiring rate measures the rate at which LinkedIn members – people with an active LinkedIn profile – report starting new jobs. This aggregate hiring has been calculated monthly, since 2017, in different industries and countries, seasonally adjusted, and compared with a baseline in 2016, set at 100. In particular, we look at the hiring rate for the technology, information and media (TIM) industry, which, as defined by LinkedIn in its custom taxonomy, appears to overlap with the definition of NACE Section J – information and communication. LinkedIn data thus capture the constant aggregate flows of individual workers into the IT sector writ large, as opposed to the ERM measuring discrete, large-scale events for the more narrowly defined ICT sector. Although LinkedIn may not be representative of the labour market at large, we believe that the IT sector may be relatively well-represented there, and that the type of events measured in the data – individuals reporting starting new jobs in a specific industry in a given month – should be relatively accurate.

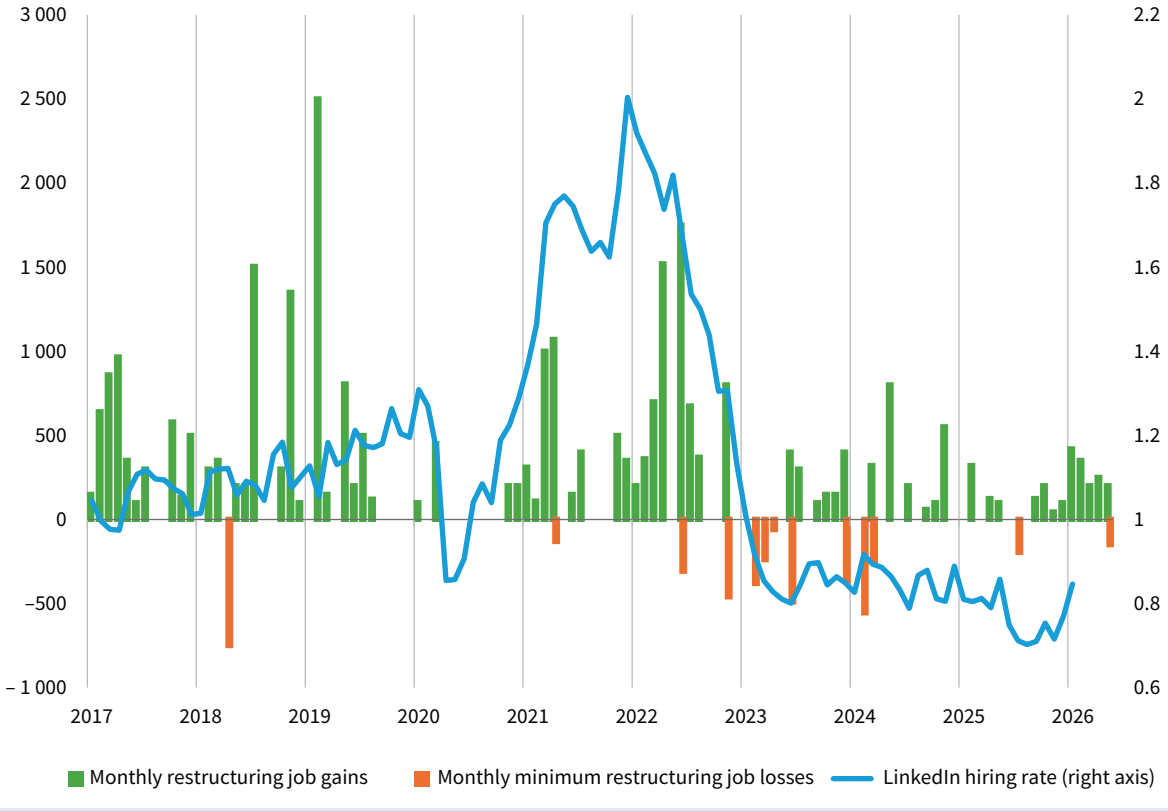
The combined recent timeline of hiring and restructuring activity in the Irish IT sector is shown in Figure 39. Between 2017 (when LinkedIn data begin) and 2020, the LinkedIn hiring rate was largely above 100, indicating that the rate of new job starts in the Irish IT sector was above its 2016 baseline. This is broadly consistent with a timeline of restructuring events in the ERM, which shows almost entirely announcements of job gains during that period. In early 2020, with the advent of the COVID-19 pandemic, the hiring rate fell abruptly, and virtually no new restructuring events were reported. This period was characterised by great uncertainty. Employees were reluctant to change jobs, and companies were pondering the implications of the pandemic for their business. With public health measures requiring social distancing and working from home, the IT sector – particularly the big tech multinationals with a presence in Ireland – was providing essential infrastructure and services to enable remote work whenever possible, across the economy, and providing communication and entertainment to those isolating at home. With the prospect of higher demand for IT services – at least in the short term, perhaps permanently, as work and social habits changed abruptly – hiring in the technology industry in Ireland picked up almost immediately and gathered pace in 2021. By the start of 2022, the LinkedIn hiring rate in Ireland was double what it was in 2017. This surge in individual hiring is partly reflected in the restructuring announcements, with a lag: many large restructuring events were announced only by late 2021 / early 2022. By the start of 2022, the rate of individual hiring had started to drop significantly, despite several companies announcing job creation at the same time.

Although the exact cause of this tidal shift is unclear, several policy changes in the United States may have contributed to a change in business climate for the IT sector, with repercussions for the Irish subsidiaries of US companies, which set the pace in the Irish IT sector. In early 2022, the US Federal Reserve started raising interest rates to combat inflation, which indirectly affected the stock prices of tech companies, which were trading at heady valuations. At the same time, a change in US tax law entered into force, making employing software developers relatively more expensive, by removing the ability to amortise their salaries as R&D spending over a long time span, as had previously been the case ([13]). These policy shifts, combined with a reported perception that the sector had been over-hiring in the previous years, relative to the increase in demand for its services, led to a change in business climate.

([13]) https://qz.com/tech-layoffs-tax-code-trump-section-174-microsoft-meta-1851783502.

By early 2023, the LinkedIn hiring rate was below its 2016 baseline, and has since remained there. As discussed, there was a round of job losses in US big tech companies in February 2023, although since mid-2024 there have been only announcements of job gains.

Figure 39: Hiring and restructuring activity in the Irish IT sector, 2017–2026



Note: The LinkedIn hiring rate (right axis) is seasonally adjusted and indexed to 1 in 2016.
Source: Authors, based on the LinkedIn hiring rate for the TIM industry and ERM data.

Over the last few years, the Irish IT sector has experienced unusual hiring dynamics, relating mostly to external factors, to which it was unusually exposed, through US big tech multinationals. Although long-term employment growth in the sector has been remarkable, particularly in Ireland, the unusually large impact of US big tech in the country shows just how much the sector can be exposed to global business cycles and policy shifts.

Given the scale of recent restructuring events in the IT sector, and concerns – however remote – about job losses due to automation, we may wonder about the chances for mobility within and beyond the sector.

The next section presents new evidence about the more common career transitions of employees between different industries.

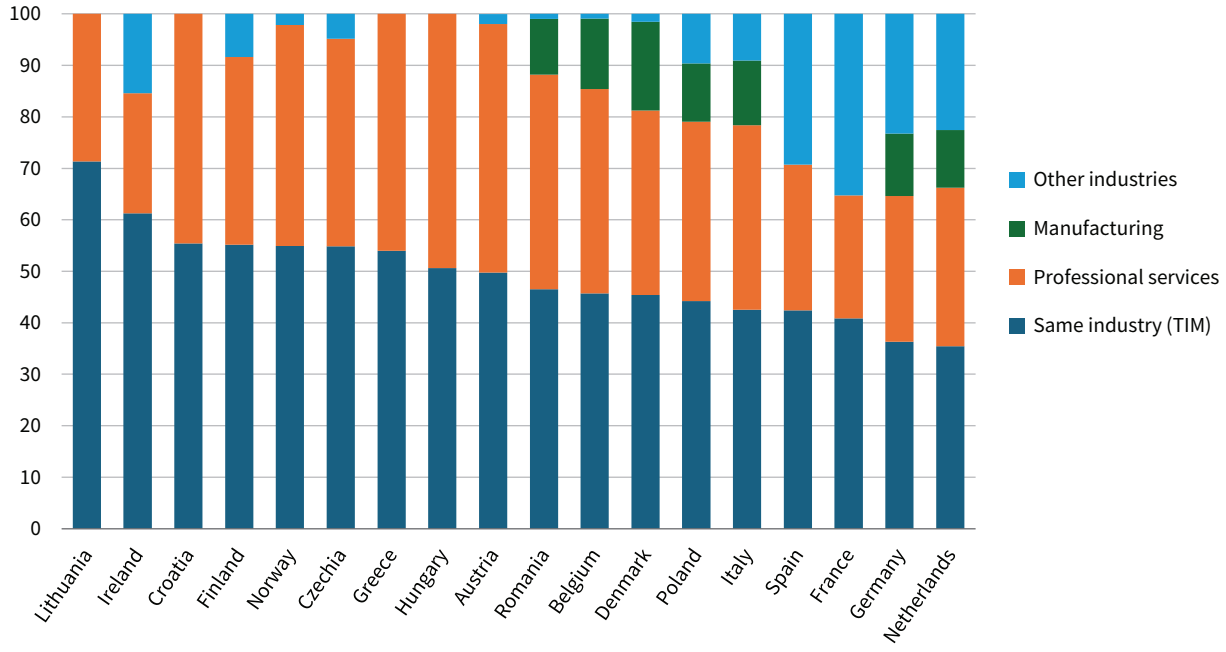
Career transitions from the IT sector

As the digital transition unfolds, the demand for IT workers is growing beyond the IT sector. As employers in virtually all sectors report challenges in hiring ICT specialists, we may wonder if the shortages will result in a competition for talent, leading to significant flows of professionals between different sectors.

Data from LinkedIn provide useful insights about mobility between industries, particularly within and beyond the technology sector. The LinkedIn Career Transitions Index tracks the relative rate of moves, measuring how frequently employees move within and between industries. The index is based on the minority of LinkedIn members who record changes on the platform, assigning an industry to the employer of previous and next job. It is calculated on an annual basis, country by country, and reports the relative flows between pairs of industries. It does not report absolute flows of people in and out of specific industries and LinkedIn requires a minimum aggregate number of such flows to compute the share of transition between industries. The unit of analysis is the sector ('industry' as defined by LinkedIn), as opposed to the occupation. Although we expect that many LinkedIn members working in the TIM industry may be ICT specialists, some of them may also work in other roles. As commented on in Box 7, although LinkedIn data may not be representative of some sectors, there are reasons to believe that the IT sector, and other tech-adjacent industries, may be relatively well-represented here, allowing for meaningful comparisons ([14]).

Across Member States, between one third and almost three quarters of LinkedIn members who changed jobs within the TIM industry, as defined by LinkedIn, remained within the same industry. In 2024, the most recent full year for which data are available, the level of such 'retention' in the TIM industry was highest in Lithuania (71.3 %) and Ireland (61 %), and above 50 % in Croatia, Finland, Norway, Czechia, Greece and Hungary, as shown in Figure 40. In the Netherlands, Germany, France, Spain and Italy, only a minority of around 35–45 % of LinkedIn members who changed jobs from an employer in technology remained in the industry.

Figure 40: Transitions from the TIM industry in 2024, selected Member States (%)



Note: Countries are ranked based on the share of transitions remaining in the TIM industry. LinkedIn does not report career transition data for all Member States, owing to data limitations.
Source: Authors, based on LinkedIn career transition data.

([14]) Note that, by construction, these data do not record LinkedIn members leaving paid employment altogether.

The retention rate of the TIM industry – averaging around 48.2 % across Member States for which the LinkedIn career transition statistics are computed – appears middling, compared with other industries. As shown in Table 2, the hospitals and healthcare and financial services industries (as defined by LinkedIn) have the highest retention rates, with more than two thirds of career transitions remaining in the same industry. At the other end of the spectrum, wholesale and utilities appear to have particularly low retention rates, but it is unclear how well-represented these industries are among LinkedIn members.

Table 2: Share of career transitions within the same industry in 2024 (%)

LinkedIn industry	Retention
Hospitals and healthcare	69.5
Financial services	69.4
Accommodation and food services	65.7
Real estate and equipment rental services	65.6
Construction	62.2
Manufacturing	60.6
Transportation, logistics, supply chain and storage	58.5
Education	57.6
Government administration	54.2
Professional services	54.1
TIM	48.2
Entertainment providers	47.8
Retail	43.3
Administrative and support services	43.2
Consumer services	37.0
Oil, gas and mining	36.6
Farming, ranching, forestry	35.0
Utilities	27.8
Wholesale	17.5

Note: The retention rate is computed as the unweighted average of the share of career transitions within the same industry, across the 18 Member States for which the LinkedIn transition rate is computed.
Source: Authors, based on LinkedIn career transition data.

Besides remaining in the same industry, the most common destination for mobile technology workers is professional services, defined fairly broadly in LinkedIn metadata to '[include] entities that perform professional, scientific, and technical activities for others, including legal advice and representation; accounting, bookkeeping, and payroll services; architectural, engineering, and specialised design services; computer services; consulting services; research services; advertising services; photographic services; translation and interpretation services; veterinary services; and other professional, scientific, and technical services'. Between 23 % and 49 % of transitions are to professional services, which is to be expected, as this collection of service sectors has a high affinity with the technology and skills within the technology sector proper. In a few Member States, between 10 % and 17 % of workers leaving the technology industry move into manufacturing – a sector for which employees are otherwise presumably not well-represented on LinkedIn. Perhaps surprisingly, transitions towards the financial services industry appear relatively marginal: they account for fewer than 10 % of transitions everywhere, with highest values in Poland (9.62 %), Ireland (8.76 %) and the Netherlands (7.99 %). This may reflect the somewhat staid reputation of technology in traditional institutions, notwithstanding the recent growth in financial technology (fintech) companies.

Overall, it appears that technology workers have opportunities for career transitions beyond the technology industry. However, LinkedIn data are silent about the causes of these career steps, whether they are driven by dismissals or restructuring, or better opportunities in other sectors.

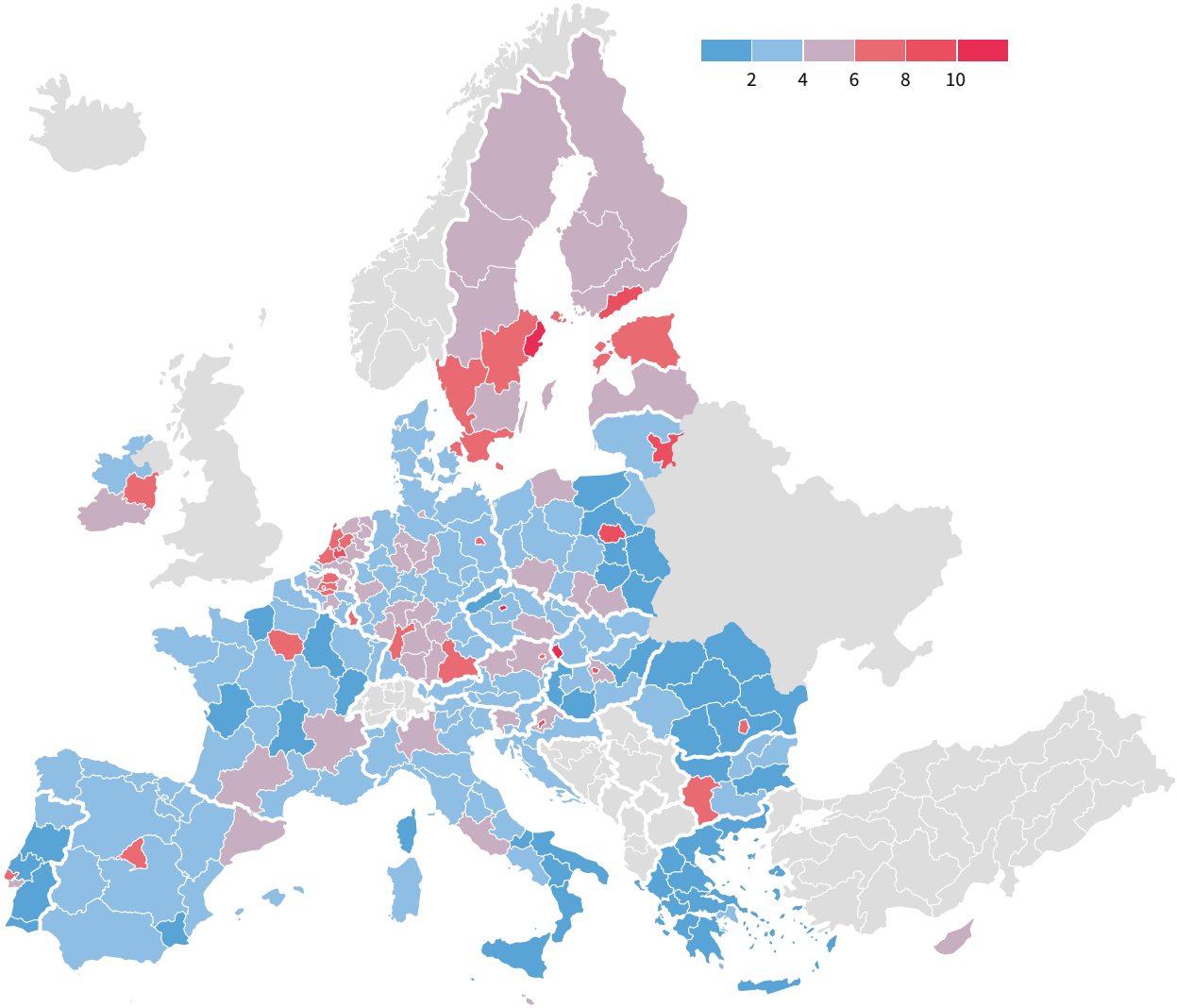
Clusters: where IT jobs are concentrated

The IT sector in Europe is highly concentrated in urban areas owing to its knowledge-intensive nature and the greater availability of people with relevant skills and qualifications in such areas. IT clusters in Europe are almost all based in cities; generally, the larger the city, the larger the cluster ([15]). Figure 41 shows the share of ICT specialists in capital cities and some larger metropolitan NUTS (nomenclature of territorial units for statistics) 2 regions. In addition, literature suggests that IT cluster development can be explained by city characteristics and by national institutions (Belitski et al., 2016).

All European capitals have an IT cluster, at varying stages of maturity. However, the most important cluster is not always located in the capital: Eindhoven (Brainport) has a larger cluster than Greater Amsterdam, and Milan has a higher concentration of IT employment than Rome. In most countries, secondary cities also record clusters that are of a smaller size and often a different specialisation than that of the capital.

([15]) This section combines data received from the Network of Eurofound Correspondents (11 Member States) (see Annex 3) and desk research, which helped provide some examples and allowed for the inclusion of France.

Figure 41: Share of ICT specialists in the total working population, by NUTS 2 region (%)



Note: The chart includes the following ISCO three-digit groups: 133, 250, 251, 252, 350, 351, 352, 742 (that is, c. 80 % of the ICT specialist population). See also Annex 1.
Source: Authors, based on ad hoc extraction of EU-LFS data.

According to Eurostat, the largest ICT headcounts (as proxied by employment in NACE Section J – information and communication) are in the regions of Paris (445 000), Madrid (250 000), Milan (191 000), Barcelona (174 000) and Warsaw (171 000). The ranking is similar to but slightly different from, in terms of start-up communities at earlier stages of growth, the EU statistics reported by Startup Genome for 2025, with Paris ranking top, followed by Amsterdam, Berlin and Stockholm (Startup Genome, 2025).

However, the large total numbers of workers in these cities are not always reflected in high regional or city employment rates. The region of Milan in Lombardy hosts 30 017 ICT enterprises and employs 221 151 workers; however, it represents only 3 % of the regional economy in terms of share of employment (Anitec-Assinform, 2024; quarterly observatory data).

By contrast, in Paris, digital technologies account for a significant portion of the Paris region's economy (13.6 % of commercial employment) and one in two ICT workers in France works in Paris (Insee, 2025).

Similarly, in Dublin, the number of workers in the information and communication sector total 93 900, representing more than 11 % of the total Dublin workforce (842 400). The ICT sector has become an increasingly important aspect of the Irish economy, with multiple major global companies choosing Dublin as their European headquarters. In particular, many tech firms are located in an area known as the 'Silicon Docks', based around the Grand Canal Dock area of Dublin, in the southern inner city. Tech firms such as Google, Airbnb, HubSpot, Zalando, Salesforce and Stripe are based in this area. Other big tech or tech-adjacent companies have located outside this area – for example, Microsoft and Mastercard operate from a campus further south in Dublin.

A very significant percentage of urban employment is also observed in Bulgaria, where the primary IT cluster is in Sofia, which, according to a 2021 regional report, employs more than 50 000 people (Sofia Investment Agency et al., 2024). The IT services and business process outsourcing sectors, which are also mainly concentrated in the capital, accounted for approximately 30 % of total employment in Sofia in 2018. The strong presence in Sofia is confirmed by 2023 data showing that, of the top 60 IT companies in Bulgaria, 41 were headquartered in Sofia, with much smaller numbers in Plovdiv (8) and Varna (6) (AIBEST, 2023).

In Denmark, the share of employment in IT and information services is relatively similar in Copenhagen (6 %) and Aarhus (5 %), with specific peaks recorded in neighbourhoods of the greater Copenhagen area: Vallensbæk (9 %) and Ballerup (8 %) (Statistics Denmark, 2025). Ballerup is often called Denmark's Silicon Valley because many international tech companies are based there (Ballerup Kommune, 2025). Many large companies choose a location in the greater Copenhagen area because of the space needed for big data centres. However, some of these companies are moving to central Copenhagen to attract the most talented employees.

A comparable pattern to the Danish one can be observed in Hungary, where Budapest and its neighbourhood are the dominant players in the Hungarian IT job market, representing 7 % of the employment in the region. Likewise, the Slovak ICT sector is concentrated in a small number of urban clusters, with Bratislava and Košice the two dominant centres of employment and firm activity.

In Croatia, the IT sector is more spread out, with the main centre being Zagreb, which accounts for roughly 4–6 % of total employment of the city and more than 30 % of Croatia's total IT employment (almost 60 000 employees in 2025).

Cluster specialisations

Europe's tech landscape is highly diversified, encompassing activities from AI to fintech. In Bulgaria, software development dominates as the core specialisation (Bulgarian ICT Cluster) ([16]). Similarly, in Lithuania, software-related activities dominate employment and growth, with software development and programming employing more than 20 % of IT workers. In Romania, Bucharest has a cybersecurity specialisation.

In Italy, the main specialisation is software and IT consultancy, with 56 707 enterprises (42.8 % of total ICT enterprises) employing 379 607 workers. IT services constitutes the second major specialisation, accounting for 41.8 % of ICT enterprises nationally. This rather broad category includes data processing, database management, hosting and application service provision, web portals, and computer and peripheral maintenance.

In Denmark, particularly in the greater Copenhagen area and Aarhus, no single IT specialisation dominates, with IT domains spanning software development and big-data processing, which has created a demand for cybersecurity expertise. However, Copenhagen serves as Denmark's principal hub for fintech innovation, with the Copenhagen Fintech Cluster also located in the area. Aarhus has emerged as Denmark's second-largest technology cluster, with strengths in software development and cybersecurity, among other things.

Similarly, in Ireland, the Silicon Docks is home to almost every type of IT specialisation, from search engines, software development and AI, to cybersecurity, IT services and social media companies. The 'fintech corridor', which straddles the border between the Republic of Ireland and Northern Ireland, is a significant and developing collection of fintech companies, academic institutions and development agencies along the Dublin to Belfast route.

Estonia has a significant number of specialisations, although with a different focus. It is a leader in e-government and has been considered the world's most advanced digital society (City of Tallinn, 2025). Estonia also ranks first in Europe in the Global Cybersecurity Index, and its capital Tallinn is home to the NATO Cooperative Cyber Defence Centre of Excellence. In Estonia, an important cluster is Healthtech Community, with a main IT specialisation in healthcare-related technology ([17]). Healthtech Community has 105 members, including companies (start-ups, health IT, biotech, medtech), R&D partners and healthcare service providers (hospitals, general practices, pharmaceutical companies), and those in other related fields, such as patient representative organisations.

Indigenous or foreign-headquartered firms?

The composition of ICT clusters varies significantly across countries, particularly in the balance between indigenous and foreign-headquartered firms. In Bulgaria, this split is relatively even at around 55:45, which shows a notable mix between indigenous and

([16]) http://www.ictcluster.bg/.

([17]) https://www.tehnopol.ee/en/business-services/health-tech-community/.

foreign-headquartered corporations (Dev Bulgaria OOD, n.d.). The Bulgarian ICT cluster lists prominent local companies such as Musala Soft, ScaleFocus and Chaos, which are indigenous leaders driving innovation in software engineering, AI and cloud solutions. Multinational corporations like SAP, VMware and HP have large Bulgarian branches or development centres, leveraging Bulgaria's competitive labour costs and skilled workforce.

In contrast, some countries exhibit a far more foreign-dominated landscape. This is particularly the case for Ireland, where the sector is dominated by a small number of foreign-owned multinational enterprises that account for the majority of output, employment and tax revenue. In contrast, the domestic part of the sector has expanded more slowly and accounts for less than 10 % of overall ICT output (Central Bank of Ireland, 2023). A similar, but less pronounced, pattern is evident in Denmark, where foreign-headquartered companies are substantially larger than Danish-owned companies. The presence of foreign firms, particularly those headquartered in countries such as India and the United States, is steadily increasing. In Hungary, the dominance of foreign firms is even more striking: according to a 2023 shared service centre survey by the Hungarian Investment Promotion Agency, American Chamber of Commerce Hungary and ABSL Hungary, nearly 90 % of shared service centres were foreign-headquartered, primarily from the United States, Germany, the United Kingdom and France (HIPA et al., 2023).

At the opposite end of the spectrum are countries where foreign presence is relatively limited. In Croatia, indigenous firms make up roughly 70–75 % of the enterprises in the sector, especially in start-up ecosystems and in small and medium-sized enterprises (SMEs). These companies often specialise in software development, fintech and business process outsourcing. Foreign-headquartered firms, accounting for the remaining 25–30 %, tend to be larger and more capital intensive, focusing on R&D, outsourcing and regional service centres. Similarly, in Estonia, the majority of IT businesses are small, domestically owned businesses: the number of companies that have more than 100 employees is below 100.

Strengthening IT clusters

In all Member States, IT companies form part of organisations or umbrella organisations called 'clusters', usually in collaboration with universities and local governments. In most Member States, these entities are institutionalised in national or regional regulation, such as in Italy, where they are effectively consortia with limited liability or associations, or in France, where they need to follow a call for application and get evaluated in order to be recognised. Although cluster organisations are active in all Member States, only around half of Member States have developed specific cluster policies (Prognos AG, 2024).

While the scope of these clusters varies, the main aims of these organisations are:

- to facilitate collaboration, information sharing and the provision or channelling of specialised and customised business support services;
- to market the cluster to increase participation of new undertakings or organisations and to increase visibility;
- to organise training programmes, workshops and conferences to support knowledge sharing and networking and transnational cooperation.

A significant number of clusters are also part of the European Rural Development Fund partnership agreements and are part of the national recovery and resilience plans (European Cluster Collaboration Platform).

Paris, the largest geographical cluster in Europe, provides a clear example of cluster organisations hosting two major IT clusters, each with a distinct focus. The first major IT cluster, Systematic Paris-Region, focuses on digital business-to-business deep tech systems ([18]). Since its creation in 2005, it has been engaging a community of about 900 members, which includes 550 SMEs, 140 corporate groups, and 160 R&D centres and research organisations. It hosts seven 'tech hubs': the Data Science & AI Hub, the Cyber & Security Hub (including defence), the Digital Infrastructure Hub, the Advanced Engineering & Computing Hub, the Optics & Photonics Hub, the Open Source Hub and the Drones Hub. The hubs aim to create new products and services and bring innovations to the market. Among the various activities, the cluster awards the 'Champion' label to a selection of SMEs with more than EUR 5 million in turnover to benefit from a premium support programme. A number of companies have received this award, including, for example, Probabl (open source and AI), Scalinx (semiconductors), Sekoia.io (cybersecurity), Uavia (drones) and Quandela (quantum computers).

The second major IT cluster, Cap Digital, focuses on digital business-to-consumer and services industries. The cluster has six main activity fields: e-education, e-health, media and entertainment, sustainable cities, retail and services, and technology data and AI. The

([18]) Deep tech systems are cutting-edge technologies. Example definitions of what the deep tech is in each field are available at https://www.eitdeeptechtalent.eu/the-initiative/what-is-deep-tech/*.

cluster works with its more than 1 000 members (including experts, very small enterprises / SMEs, major groups, research and training organisations and venture capitalists) to help them find the support, connections and financing they need for their innovative projects. Since the creation of Cap Digital, the cluster has invested more than EUR 1.8 billion in R&D ([19]).

Even in countries that have fewer IT workers, such as Bulgaria, there are such organisations. The ICT Cluster acts as an umbrella organisation of the Bulgarian ICT industry. It has 10 members among ICT associations and comprises more than 280 SMEs from various industry segments, and six Bulgarian technical universities. There are also IT clusters in cities such as Varna ([20]) and more recently Burgas ([21]).

Similarly, Estonia has developed its own cluster ecosystem. The most prominent one is the Estonian ICT Cluster, related to the Estonian Association of Information Technology and Telecommunications, which includes 36 members from educational institutions, cybersecurity, software development and telecommunications companies. The majority of the member companies are indigenous, with a few exceptions.

According to the Czech National Cluster Association ([22]), there were 110 clusters and technological platforms in Czechia in 2025, of which approximately 10 % are related to the ICT sector. Most of the clusters can be found in the eastern part of the country in the Moravian Silesian region, which has a total of 24 clusters, of which 7 are ICT sector related. Other ICT-related clusters are distributed evenly in other regions, mostly near large cities (Prague, Brno, Ostrava, České Budějovice, etc.) (CzechInvest, 2023).

Universities are also an important part of the clusters, allowing for sharing talent and the latest R&D research. In Czechia, the interaction between universities and research institutions in clusters is high (CzechInvest, 2023). Nearly every ICT cluster has among its members at least one university and some have developed links with secondary schools.

In Croatia, the university presence is primarily achieved through the University of Zagreb, which feeds talent into the sector, particularly through the Faculty of Electrical Engineering and Computing ([23]). The faculty works closely with industry to turn technological advancements into real-world solutions.

In Ireland, major tech companies also collaborate with universities directly. AWS, for example, works with several Irish colleges and universities, including the Technological University Dublin, Dublin City University and the University of Limerick, as part of its AWS Academy and AWS Educate programmes. The AWS Educate programmes provide member institutes with no-cost access to learning content and AWS services.

A crucial role in the creation of these clusters has been played by the possibility of requesting national and European funds and instruments, in particular the European Regional Development Fund. For example, in Hungary, significant funding was allocated for science parks, incubators and digital competence centres. Additional projects ([24]) were also co-financed through Interreg projects, particularly in the Danube region.

External funding does not always play a crucial role at the cluster level. For example, in the case of the Estonian ICT Cluster, members include firms and universities, but no public sector organisations are included. The cluster activity is not funded by the public sector but is funded directly by its members; however, the fact that companies need to contribute financially to be able to participate leads to a lower likelihood that smaller companies join it.

The Netherlands illustrates how national fiscal incentives also complement cluster development. Companies that work on R&D – for example, for software innovation – can make use of the Research and Development Promotion Act (Wet Bevordering Speur- en Ontwikkelingswerk, WBSO) subsidy. This subsidy is granted for projects that develop new software based on new IT principles. This is especially relevant for IT clusters in the Netherlands as it reduces costs for product development. In addition, the WBSO gives access to the 'innovation box' policy, which further reduces corporate taxes. While the innovation box reduces the tax paid on profits, the WBSO reduces the costs of doing the research in the first place. Only innovative businesses can make use of the innovation box and the main conditions for being eligible are self-developing an intangible asset, receiving the WBSO subsidy for its own R&D personnel, and, for large taxpayers, 30 % of the profits coming from R&D activity.

([19]) https://www.capdigital.com/en/who-we-are/our-ecosystem/.

([20]) https://ictclustervarna.com/.

([21]) https://ictc-burgas.org/en.

([22]) https://nca.cz/.

([23]) https://www.fer.unizg.hr/en.

([24]) http://www.ictcluster.bg/projects/.

Also in the Netherlands, another interesting policy has been the fund AiNed. It supports businesses and public institutions with the introduction and use of AI. The goal of the investment is to reduce the barriers to AI usage. Investments are made to support innovation, acquire knowledge, and support the labour market and society in the sharing of data. Under the AiNed there are different funding calls. An example is the SME innovation stimulation top sectors for artificial intelligence scheme, which supports SMEs in developing and applying AI innovations. Through collaborative R&D projects, companies innovate products, production processes and services with the help of AI. An example of a project financed via the scheme is the GeoAI Platform for Accessible and Automated Geospatial Intelligence Operations. The goal of the platform is to ease access to high-end 'geospatial intelligence' – which is the analysis of imagery and data linked to specific locations on Earth – making it usable for organisations that lack deep technical expertise in AI or satellite data processing.

A significant number of European countries have tax incentives for R&D that, more specifically, can be used by ICT companies. Poland has a so-called IP box, which allows the income derived from the copyright of a 'qualified intellectual property' – such as original AI algorithms, datasets and pre-processing code – to be taxed at a competitive rate.

In summary, the IT sector in Europe is characterised by city clusters, which form large networks and connect businesses, governments and universities. The clusters differ significantly in how they are organised and in their ownership and main focus. The biggest clusters can largely be considered well-established, especially since in most countries they are part of long-term, long-standing national policies. In smaller cities, a number of new clusters are also emerging.

The future growth of the IT clusters will be linked to new constraints such as energy demand, sustainability pressures and infrastructure capacity. These new challenges will constrain or become a competitive advantage depending on the cluster locations and national and regional policies. Overall, in most European countries, there is a significant number of policies in place to support cluster activity and incentives to innovation. However, more could be done to collaborate, cross-nationally, across clusters and cities working on the same thematic areas within Europe.

4 Recent developments in social dialogue in IT

In this section, contributions from 12 Member States (see Annex 3) on trends and recent developments in union and employer representation in the IT sector are summarised. These were in the form of responses to a brief questionnaire (see Annex 3) completed in summer/autumn 2025. The objective of the exercise was – for a selection of Member States – to update our knowledge of social dialogue in ICT deriving from the 2019 Eurofound study *Representativeness of the European social partner organisations: ICT-telecommunications sector* (Eurofound, 2019). In particular, the national correspondents were asked to indicate whether union density and collective bargaining coverage were increasing or decreasing, to outline emerging workplace issues for unions and employer organisations in the sector, and the extent of their involvement in workplace restructuring.

For European Sectoral Social Dialogue Committee (SSDC) purposes, the ICT sector is defined more narrowly than in other operationalisations (see Annex 1) and was covered only relatively recently, being integrated in the SSDC for telecommunications in 2015 (European Commission, 2025a).

The motivation for the integration was convergence in the activities and technologies of the two sectors. According to its proponents, information technologies are dependent on communications infrastructure (internal and external networks, such as the internet) and therefore each sector benefits from advances in the other and contributes to processes of digitalisation pervasive across all sectors of activity (Eurofound, 2019).

A fast-growing sector but with limited social partner representation

However, in terms of business demography, the two subsectors – telecommunications (NACE 61) and ICT (NACE 58.2, 62 and 63.1) – are quite distinct: they have different employment levels and growth rates and distinct historic developments, with consequences for the operation of sectoral dialogue in each sector. In 2024, the telecommunications sector in the EU employed around one million people compared with more than five times that number in the ICT sector. A large majority of telecommunications employment is in a small number of large enterprises where collective representation has strong roots, even if collective bargaining remains mainly at the company level rather than the sectoral level. The sector was one of the first to be liberalised in the 1990s and early 2000s, transformed from a largely nationally organised and often state-run monopoly into an internationally exposed business sector. Employment has been stagnant or contracting in this sector over the last two decades (EU-27 headcount in 2024 was 16 % lower than in 2008).

By contrast, there are more than 1 million ICT companies in the EU according to the Structure of Business Survey, including a large share of small enterprises and microenterprises. These enterprises also tend to be younger, and union density and collective bargaining coverage are generally lower than the national average. Computer programming, consultancy and related activities (NACE 62) is among the sectors with the fastest employment growth of all NACE two-digit sectors.

Both subsectors are covered by the telecommunications SSDC, with UNI Europa (the European regional branch of UNI Global Union) representing the union side and Connect Europe (formerly the European Telecommunications Network Operators' Association, ETNO) representing the employer side. This is indicative of the roots of the SSDC in the telecommunications sector. Connect Europe presents itself as the 'voice of the leading providers of connectivity networks and services in Europe'. DigitalEurope, the main trade association advocating for the ICT sector, represents some 45 000 businesses in the EU. It is not formally part of the SSDC, although there is ad hoc cooperation between it and its SME counterpart European DIGITAL SME Alliance, for example, and both of the main representative organisations at the EU level.

According to evidence from the national correspondents contributing to this study, in the period since the most recent Eurofound representativeness study on the sector (Eurofound, 2019), collective representation in the two subsectors has remained largely separate. Coordination is much better in the telecommunications sector because of higher levels of union membership and collective bargaining coverage, while representation in the IT sector is fragmented on both the union side and the employer side, where often the most influential bodies are trade associations rather than employer organisations with formal social dialogue and bargaining mandates. Union membership levels were, in the main, lower or much lower than the national average in the IT sector across all of the 12 Member States covered (see Table 3).

Table 3: IT sector union density and collective bargaining coverage, recent trends

Country	Union membership	Trend	Share of collective bargaining coverage	Trend	Notes
Austria	Lower than the national average of around 25–27 %	Not indicated	'remains extremely high'	Stable	Mandatory employer membership in the Austrian Federal Economic Chamber and the sectoral IT collective agreement (IT-KV) (covers 90 000 employees).
Bulgaria	Membership 'almost inexistent' in the IT sector	Not indicated	Not indicated	Not indicated	Most prominent organisations representing the sector are trade associations (Basscom, AIBEST, ICT Cluster Bulgaria and BESCO) but none have obtained representative status; only AIBEST has applied.
Denmark	Lower than the national average	Increasing at PROSA	30 % (PROSA estimate) versus c. 75 % in private sector	Increasing	One IT specialised union (PROSA) but union membership of IT employees noted across 7 unions (fragmented).
Finland		Mixed, depending on union, but more decreasing	Two collective agreements in Finland covering white-collar workers in ITC sector. Coverage 'similar to the national average (84 %) and in some parts slightly higher', though this relates to telecoms (NACE 61). Another collective agreement covering IT services workers shows declining coverage, from 57 % to 33 % based on latest data (2021)	Negative on balance	Increase in IT services employment but decline in share of workers in 'organised companies', that is, those affiliated to an employer organisation. The previous general applicability of the latter collective bargaining agreement has recently been removed.
France	Estimated at around 5 %, or half the national average (10 %)	Not indicated	Pervasive practice to extend sectoral collective agreement to all employers and employees, so near 100 % collective bargaining coverage	Stable	Fragmented worker representation. To be representative at branch level, trade unions have to reach the thresholds of 8 % of the votes at workplace elections calculated every four years. Five currently do so.
Greece	Very low, significantly below the national average	Not indicated	'Almost non-existent at sectoral level. There is no sectoral collective agreement for IT. Coverage exists only through company-level agreements, and only in a handful of large firms'	Stable to declining	
Hungary	Low; IT sector workers often represented by unions in other sectors	Declining	Estimated at 3 % in 2025	Declining	New legislation passed in 2024 has made union activity more difficult. 'The national social dialogue committee for ICT has had a troubled existence since being established in 2010, with its representativeness credentials questioned when the committee's licence came up for mandatory five-yearly renewal. It was declared defunct in 2024.'
Ireland	8 % in broader information and communication sector; likely lower in IT; below national average (26–28 %)	Increasing from low levels due to active recruitment by the Financial Services Union and the Communication Workers' Union	'Largely non-existent in the private IT sector', below 5 % and likely nearer 1 %. Compared with 43 % of employees covered by collective bargaining nationally	Not indicated	Unusually, collective bargaining coverage is probably lower than union membership level due to the widespread lack of union recognition in the IT sector. None of the major employers in the sector (Google, Meta, Microsoft, TikTok) recognise trade unions and they are more likely to be hostile to union recognition.
Netherlands	6 % (broad information and communication sector) versus 15 % nationally	Not indicated	Collective bargaining coverage nationally decreasing but the decrease is stronger in the IT sector, especially in the service-focused parts	Declining	Collective agreement for IT sector 'not generally binding'. Between 2014 and 2022, the number of employees covered by the information technology, communication and office technology collective labour agreement (known as the CAO) fell from 30 000 to 8 000.

Country	Union membership	Trend	Share of collective bargaining coverage	Trend	Notes
Portugal	4 % in information and communication sector in 2023 versus 7 % in total economy except public administration sector	Declining rapidly in broader information and communication sector, from 11 % (2013) to 4 % (2023)	Just over half of employees (52 %, 2023) in the main IT sectors covered by collective agreements or administrative ordinances	Declined in main IT sectors (NACE 62/63) from 66 % to 52 % between 2013 and 2023	There are also low rates of employer organisation membership among companies in the information and communication sector (4 %). As a result, large shares of employees in the IT sector are covered by *Portarias de Condições de Trabalho* (PCTs, administrative ordinances where there is no employer organisation with a mandate to negotiate with unions).
Romania	Estimated at 6–7 % compared with 26–27 % national average	Increasing; SITT has doubled its membership in the IT sector since 2019	The only employer organisation in the sector, ANIS, has not filed for representativeness. This limits collective bargaining coverage to local or company agreements	Not indicated	SITT, along with smaller unions, obtained representative status in May 2025. Originating as a company union at Alcatel-Lucent, SITT now has some 8 000 members in the country's large IT multinationals. There is, however, little or no social dialogue at national sectoral level.
Sweden	Not indicated for IT sector but high overall; 66 % in 2024	Not indicated for IT sector but declining overall, especially among blue-collar workers	Low levels of employees with collective bargaining coverage (52 %) compared with national average	New sectoral agreement in 2025	In 2025 TechSverige, Unionen, Sveriges ingenjörer and Akavia signed a new collective agreement. The agreement covers approximately 1 000 IT and tech companies (c. 71 % of Tech Sverige's company affiliates) and 55 000 employees and is valid until March 2027.

Source: Authors, based on information received from the Network of Eurofound Correspondents.

In Member States with different levels of collective representation, like Austria and France, extension clauses mean that nearly all IT sector employees are covered by collective bargaining agreements, despite – in the case of France – sectoral union membership rates that are below the national averages. While not as pervasive, bargaining coverage in the sector is also high in Portugal and in the Nordic countries – with estimates ranging from 30 % to 52 %. However, bargaining coverage was reported as weakening in Finland, where declines in the share of workers in companies affiliated to an employer organisation had led to the removal of the general applicability of the sectoral collective agreement and where a correspondent noted 'a resistance to large and centralised trade union negotiations'. This is reflected in the splitting of the main employer organisation into two, with a new organisation emerging: Technology Industry Employers of Finland actively negotiates sectoral collective agreements for its member companies, while its original counterpart Technology Industries of Finland continues to act as a main lobbyist for the sector, representing employers preferring company-level agreements. In the Netherlands, employers are reported to prefer avoiding extended, binding sectoral agreements. As no employer organisations have obtained representative status, the sectoral information technology, communication and office technology collective agreement remains not generally binding.

Lack of representative status for employer organisations has also undermined social dialogue in the sector in Bulgaria and Romania. In Hungary, the national social dialogue committee in the ICT sector was 'declared defunct' in 2024 for a second time, because of reported representativeness deficits. In Portugal, one quarter of IT sector workers are covered by working conditions ordinances (*Portarias de Condições de Trabalho*, PCTs), which establish minimum working conditions for employees in sectors where there is no employer organisation with a mandate to negotiate collective agreements with relevant unions and where, as a result, an extension ordinance cannot be applied.

Ireland is a distinctive case in that it has a comparatively large IT sector in employment terms, it is highly concentrated in foreign-owned (mainly US) big tech firms, and there is no legal obligation on employers to recognise or collectively bargain with unions. As a result, collective bargaining coverage is minimal in the sector. This leaves other avenues by which trade union and employee representative voices can be heard on a collective level, mainly arising because of the implementation of EU directives: redundancy consultation, health and safety representation and European works councils.

The redundancy path has been in play in recent years following large collective redundancies announced at companies such as Alphabet/Google, Meta/Facebook and TikTok in 2022 and 2023. It is noted, however, that there is no evidence that any of these companies deal directly with the trade unions. Instead, employee representatives are assisted by trade unions outside meetings with employer representatives. Another potential point of entry for union action in the sector

has been the establishment of European works councils. Google and CommScope have a European works council agreement in place in Ireland, while Meta and Microsoft are at the special negotiation body phase of establishing a council. According to the Irish correspondent, union membership in the Irish IT sector is increasing, albeit from low levels, with the Financial Services Union and the Communications Workers' Union (CWU) actively recruiting in the sector, notably during and after the wave of IT sector collective redundancy announcements noted above (see also Malone (2023)).

Various reasons for the low levels of collective representation in the sector are cited in the correspondent contributions. These include:

- strong individualised career orientation among IT professionals;
- high growth rates and demand for IT professionals leading to a boost in individual bargaining power (this is also associated with higher turnover in the form of voluntary resignations);
- higher-than-average shares of self-employment, outsourcing and other newer forms of employment (digital nomads, body shopping, platform-mediated freelance work);
- employer needs for greater flexibility in a dynamic, fast-changing sector;
- a culture of union resistance on the part of some large employers, especially large US-based tech firms;
- larger shares of younger highly qualified workers, with lower levels of union density;
- larger shares of small enterprises and microenterprises, or large, often foreign-owned, private enterprises.

All of these factors are associated with low levels of union membership.

To the above factors can be added the difficulties of union organisation and recruitment in the knowledge economy post-COVID-19, where a larger share of workers are working from home on any given day and less easy to contact, organise or mobilise.

Declining levels of membership, coverage or negotiating mandates among representative employer organisations can create a self-fulfilling prophecy of decline. The advantages of collective action or representation are lost as the share of active members or firms decline. With reference to the Dutch situation, the correspondent notes the problem of the decline of the Dutch polder model: 'as employer organisation erodes so does the foundation of collective bargaining. Once coverage drops below the threshold for extension (55 %), recovery becomes extremely difficult leading to a downward spiral'.

ICT: dispersed workforce and fragmented representation

Given comparatively limited or undeveloped social dialogue structures specific to the IT sector, IT specialists in some of the Member States covered were more likely to be represented by larger unions active in other sectors. In Hungary, 'industrial relations and trade unions' bargaining power in general have been dwindling for decades, so a sector with very little [union] activity may [be] even more likely [to] be merged with other sectors in employee representation … An IT subsidiary created at a large healthcare provider will see its employees – mainly IT professionals – represented by a healthcare union.' In some Member States, engineering and telecommunications unions represent many IT workers. This is also the case for 'white-collar' unions (for example, Pro in Finland) or 'in larger, broader unions that also represent other professional groups' (for example, Unionen, Akavia, Sveriges Ingenjorer and Ledarna in Sweden). There are more IT specialists working outside IT sectors per se and many of these workers will be covered by collective bargaining agreements in those sectors and be represented by the trade unions of those sectors.

In Denmark, cross-sector union initiatives have shown intent and growing interest in representing IT workers, but the correspondent notes that 'their effectiveness is tempered by the sector's structural complexity and the inherently decentralised nature of IT employment'. A representative from a specialised IT sector union in Denmark (PROSA) underlined the importance of working together with other unions to represent member interests.

In Ireland, as already noted, the rapid growth of IT employment has led to unions in other sectors with stable or stagnant employment targeting recruitment in the large-employing IT firms (for example, Meta, Google, TikTok and Microsoft), notwithstanding the generally union-resistant stance of such firms. The Financial Services Union has set up a branch called Game Workers' Unit, which represents game workers in Ireland. The CWU has a new division called the Digital and Techworker Alliance and indicates that there is an upward trend in union membership in the specific areas in which it is focused – largely around content moderation, data annotation for AI training, and other work typically associated with business process outsourcing firms, including providing services to the big tech firms, many of which have their European or EMEA headquarters in Ireland.

Unions mobilising to support content moderators

Content moderators comprise one of the IT sector target groups that unions have mobilised to represent in different countries. Content moderation involves labour-intensive tasks, not reliant on IT specialist qualifications in the main. These tasks are also information intensive and can involve high psychosocial risk exposure. Growing alarm about antisocial content online – pornography, violence, hate speech, defamation and disinformation – obliged the large social media platforms in the mid-2010s to actively combat such content using large teams of content moderators generally employed at arm's length from the big tech firms by business process outsourcing firms.

The EU Digital Services Act has included additional regulatory obligations on the largest online platforms – those with at least 45 million users per month – given the significant role they play in our societies and democracies. In particular, these large platforms (that is, very large online platforms and very large online search engines) must identify and analyse widespread risks. These risks include (European Commission, n.d.):

> *The spreading of illegal content, as defined in national or EU laws*
>
> *Threats to fundamental rights, such as freedom of expression*
>
> *Threats to media freedom and pluralism, public security and electoral processes*
>
> *Gender-based violence, public health, protection of minors and physical and mental wellbeing*

The large firms active in this area in Europe include Teleperformance, Concentrix, TELUS, Covalen and Accenture. Teleperformance is estimated to employ around 10 000 content moderators in Europe, concentrated in hubs in Athens, Dublin, Barcelona, Lisbon, Warsaw and Vilnius, serving different language groups and addressing specific content-related issues. The consulting group Accenture has large content moderation contracts with Meta (Facebook and Instagram) and Google (for YouTube). The two largest European content moderation hubs are in Lisbon and Dublin, with at peak levels an estimated 8 000–10 000 individuals working in content moderation in each city.

The focus of work varies by hub: Dublin specialises in high-risk, policy-related complex cases, often with potential legal implications; Warsaw specialises in political disinformation, notably after the beginning of Russia's war of aggression against Ukraine; and Lisbon and Barcelona focus more on screening and filtering the high volume of reported graphic content online. This latter work is often intensive and psychologically stressful with a resulting demand among workers for representation to address issues of stress and work-related ill health. In Portugal, the trade union CESP called strikes in June 2025 at Accenture to demand better working conditions; higher wages; meal allowances; a risk allowance for workers who review graphic, violent or sexual content; and access to psychological support and counselling.

Demand for content moderation services is likely to have waned with the change of administration in the United States in January 2025. The Trump administration's more laissez-faire approach to online content has been mirrored in public pronouncements by chief executive officers of some of the large social media companies. Mark Zuckerberg of Meta, which had previously rolled out extensive 'trust and safety' policies and operations in Facebook, reversed course in early 2025, announcing that Meta would henceforth be eliminating third-party fact-checking on its platforms in the United States, relying on user-initiated moderation via Community Notes, prioritising 'free expression' and reducing 'censorship' of online content.

An additional threat to content moderation jobs is displacement by AI. An announced restructuring by Chinese social media platform TikTok in March 2025 expects the loss of 800 jobs worldwide. The job losses will mainly affect content moderation teams, including the closure of TikTok's moderation office in Amsterdam (300 jobs). A similar announcement was made in its Berlin office in July 2025. The main cited reason for the job cuts is that TikTok wants to use AI, instead of employees, for content moderation. The company claims that 80 % of harmful content is now removed automatically.

Box 8: Contrasting approaches to social dialogue at the company level

Union representation in the IT sector has been an area of contention in many Member States. Disputes have arisen over failure to provide space for union gatherings (Altice and Accenture in Portugal), non-inclusion in or failure to negotiate or conclude collective agreements (Spotify in Sweden, Netcompany in Denmark, Intelcia in Portugal) and failed efforts to set up alternative non-unionised employment representative entities in place of existing unions (Infosys in Romania). The large French business process outsourcing firm Teleperformance has had fraught relations with unions in Greece – over pay, employee surveillance and alleged intimidation of union representatives – but employees at the Irish subsidiary Teleperformance Ireland have secured union recognition and a path to achieve collective bargaining following the company's signing of a local agreement with the CWU. This followed the signing of a global agreement between Teleperformance and UNI Global Union in 2022. The agreement is notable in two respects. First, there is no legislative obligation to honour and enact the global agreement in Ireland, and, second, all of the employees of Teleperformance Ireland work remotely.

Provisions in the agreement include:

- recognition of the CWU as the legitimate representative of Teleperformance workers in Ireland;
- the right to collective bargaining once the union has reached a membership threshold of 40 % of employees;
- union access, enabling the CWU to engage with workers in a neutral environment, provide information about their rights and promote union membership;
- respect for freedom of association, ensuring that workers can unionise without interference or retaliation.

In summary, the IT sector has lower levels of collective representation than other sectors in most, if not all, the Member States covered in this review, on both the employer side and the employee side. This does not prevent collective agreements from covering the majority of IT sector employees in Member States with developed social partner representation structures (see Box 8), mainly through extension clauses. In other Member States with less-developed social dialogue, union membership and collective bargaining in the sector are often weak and, in some cases, non-existent. The trends in both density and coverage in the sector are mixed but with a majority of the covered Member States indicating stable or declining coverage. One specific emerging weakness is a reducing number of employer organisations with a mandate to negotiate collective accords. Nonetheless, there are examples of positive collaboration between unions and management – going beyond what is required by legislation – and examples of contested representation in a context where many of the larger employers are not EU-headquartered and have different traditions of management–employee relations.

One category of IT worker that barely existed 20 years ago but has grown rapidly in the slipstream of the large social media and tech companies is content moderators. This group has been the target of union recruitment efforts given their difficult and sometimes stressful working conditions. EU regulation has strengthened moderation obligations on social media companies' potentially increasing demand for such workers, but geopolitical, commercial and technological developments (AI) appear to be contributing to reduced demand.

5 Conclusions

What is the IT sector? There are a variety of taxonomies of the IT or ICT sector. Some are narrow and some are very broad. An important orientation for this report was that the main EU policy target for IT employment is occupational rather than sectoral – the goal being to have 20 million ICT specialists in the EU by 2030.

This reflects the reality that ICT, rather than being a sector, refers more to a set of skills that are deployed not just in the IT sector – however defined – but increasingly across all sectors of the economy. ICT specialists constitute the skilled workforce – of software developers, database analysts, network security experts, for example – that is essential if the EU is to be successful in its digitalisation transformation.

ICT specialist work is knowledge intensive and involves tasks that are complex and cognitively challenging. It is also characterised by its exposure to technological change, which has been especially rapid in digital technologies. This is evident in the frequent roll-out of new digital tools and the rapidity of their evolution thereafter. Generative AI tools, for example, have gone from being an area of specialist research to being more or less ubiquitous in a very short time (2022–2026), with an estimated 1 billion users worldwide. One of the first applications of generative AI was to write computer code, a task traditionally carried out by ICT specialists.

Because of the general applicability of their skills and potential for enhancing productivity, ICT specialists are in high demand. Employment growth rates for ICT specialists have been several times greater than overall employment growth over the last two decades. The narrow ICT sector accounts for most of this headcount growth for IT specialists, but many other sectors are competing for the same talent, including manufacturing, financial services, healthcare and public administration.

This growth, however, is from a low base. ICT specialists represented only 1 in 20 workers in the EU in 2024, and at current rates will fail to meet the 2030 numerical objective – equivalent to nearly 1 in 10 workers. If this target is not met, this will be despite rapid employment growth in the digital workforce. It may be worth asking whether a headcount target that appears so ambitious serves a useful policy function, as it displaces attention from other goals that may be more achievable. Given the evidence presented on occupational compositional shifts and potential skills obsolescence within the digital workforce, policy targets could focus instead on the pace of occupational upgrading (professional share of employment) and on increasing training / lifelong learning intensity.

Demand for ICT specialists is increasingly skewed towards higher-skilled job profiles. The share of ICT professionals within the overall ICT specialist population is increasing and the fastest-growing specialisations – AI and cybersecurity – are especially skill intensive, often requiring advanced academic qualifications, up to doctorate level. However, the output of relevant PhD qualifications from EU education systems has not kept pace with this demand; evidence points to a contracting supply.

Specialisation has led to employment concentration: only one in five EU firms employs an IT specialist, and IT specialists are much more likely to be employed in large firms than in small ones. The clustering of IT activity in or around large metropolitan areas, often in proximity to universities, is another dimension of concentration, which can lead to regional imbalances within countries. Evidence from Ireland shows that unmet demand for IT expertise is a much greater problem for employers outside the capital city, although increased incidence of remote work and the teleworkable nature of much IT work may in part address such imbalance.

Skills shortages are therefore the main problem facing the sector, and one receiving close policy attention. Some 1 in 10 firms hired or tried to hire an ICT specialist in 2023 and more than half of these firms say they experienced difficulties. A lack of applications, inexperienced or underskilled applicants, and high salary expectations were all cited equally often, in firms of all sizes.

At the same time, there is mixed evidence on the provision of IT-specific training by firms. According to the Eurostat survey on ICT usage by enterprises, only around one in five firms in the EU provided some form of ICT-specific training for their employees in 2023, whether they were ICT specialists or not. Large companies were much more likely to provide training than smaller companies, and that training was more likely to be taken up by ICT specialists than employees in other functions. By contrast, Eurofound's EWCS, which is based on worker responses, indicates that ICT specialists have higher-than-average access to employer-paid training (of any kind) and to on-the-job learning.

Given the limited supply and high demand, it is not surprising that employers have sought alternative channels to address skills shortages, notably with recourse to the global IT labour market via employment permits for 'critical occupations'. These allow qualified non-EU nationals to take up job offers in the EU.

Restrictive immigration policy elsewhere is likely to have made Europe a more attractive location for non-EU experts, including in specialisations with high global demand, such as cybersecurity, machine learning or AI, and cloud computing. Notably, labour migration from non-EU countries has been a much more important contributor to recent employment growth than intra-EU labour mobility, suggesting that deficiencies in the educational pipeline for advanced IT skills are common across the EU. Such deficiencies also imply a greater potential to mobilise existing EU tools, such as the EURopean Employment Services (EURES) network.

Despite the notable challenges in relation to fast-changing skills requirements, this report has demonstrated that, in general, IT specialists also enjoy above-average employment and working conditions across nearly every dimension of job quality. They are well-remunerated for their expertise and have greater autonomy and flexibility, and higher levels of job and employment security. This is despite the relative weakness of social dialogue in the sector. Even if most ICT specialists earn well above statutory minimum wage, collective bargaining coverage in the sector can be enhanced in line with the provisions of the EU Minimum Wage Directive. At present, coverage falls well short of the EU-targeted 80 % threshold in the IT sector in most Member States covered in Chapter 4.

Because job quality is high for the digital workforce, it is unlikely that the prevalence of labour and skills shortages in the IT sector can be attributed to unappealing working conditions – as has been the case in the health or care sector, for example, where job quality is often challenging.

There is, however, an important exception to this positive assessment of working conditions in IT. EWCS data reveal several sharp divergences by gender across different job quality dimensions. These gaps are consistent in direction with better-known gaps that are well-flagged and monitored for policy purposes, such as in employment and pay. Female IT specialists, in particular, are paid less, are much less likely to consider themselves fairly paid for their work effort, have less access to paid training, are exposed to higher levels of work intensity and adverse social behaviours, and have less influence over how their work is organised.

Outcomes like these may be discouraging women from entering the field and may contribute to explaining why the share of women who enrol and graduate in ICT or STEM subjects is larger than the share of women who take up paid employment in ICT specialist occupations. Fewer than one in five ICT specialists are women. The persistence of the resulting gender imbalance is limiting the diversity of perspectives in shaping technologies that increasingly influence all aspects of society, in work and outside work.

From a policy perspective, the EU's focus on closing the gender employment gap in IT is a matter not just of equity or diversity but of economic necessity. In a context of labour shortages, failing to attract women means that the EU is operating with less than three quarters of its potential ICT specialist talent pool.

The IT sector is emblematic for EU policy on skills shortages and is often used as a justification for policies such as subsidised training and work permits for non-EU nationals. Such solutions are more justified when applied to IT work than work of other sectors. This is linked to the tools of IT work evolving fast, leading to skills obsolescence.

International recruitment may address immediate shortages, but the data presented here underscore the necessity of increasing the domestic skill base. Measures that harness the potential of young people more broadly, including those who are qualified in other disciplines, show great promise. The increased incidence of postgraduate conversion degrees can offer an alternative path to IT employment, especially in a context of declining entry-level recruitment more generally.

Investment will assist this and there are generous EU and national subsidies available across an abundance of schemes and initiatives, especially in the high-skill areas. However, take-up of ICT and STEM training possibilities appears wanting. In this case, demand is failing to meet supply. As the EU strives to achieve competitiveness and strategic autonomy in the digital domain, more must be done to develop a talent pipeline for the indigenous tech sector.

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Annexes

Annex 1: Definitions and data

This annex compares the various definitions of 'IT sector' or 'IT workers' and related terms used in this report, and how they are implemented in different sources of data. The primary focus of the report is people working with information technologies, both software and hardware. Although this domain is often called 'information and communications technologies' – and hence the categories of 'ICT sector' and 'ICT specialists' are used by Eurostat, for example – whenever possible, we exclude occupations and sectors relating to telecommunications technology and focus on a narrower definition of the IT sector, centred around software and computers.

Sectoral classifications of IT

Information and communication (NACE Section J). NACE (Revision 2), the sectoral statistical classification of economic activities, mentions IT-related activities at various hierarchical levels. At the most aggregate, one-digit Section J – information and communication – includes elements of IT services (in bold in the list below), but also includes media, broadcasting and telecommunications. Section J comprises the following:

- 58 – publishing activities, which includes:
  - 58.1 – publishing of books, periodicals and other publishing activities,
  - 58.2 – **software publishing**;
- 59 – motion picture, video and television programme production, sound recording and music publishing activities;
- 60 – programming and broadcasting activities, which includes:
  - 60.1 – radio broadcasting,
  - 60.2 – television programming and broadcasting activities;
- 61 – telecommunications (wired, wireless, satellite, other);
- 62 – **computer programming, consultancy and related activities**;
- 63 – information service activities, which includes:
  - 63.1 – **data processing, hosting and related activities; web portals**,
  - 63.9 – news agency activities and other information service activities.

Technology, information and media (TIM) industry (LinkedIn). A broadly similar definition is used in LinkedIn data, despite LinkedIn using a custom industry classification. The industry overlaps with that of NACE Section J – information and communication. It is defined in LinkedIn metadata to '[include] entities that produce technology products, such as software and data analytics, and provide the means to transmit or distribute these products. Also included are motion picture and sound recording; traditional broadcasting and broadcasting exclusively over the internet; telecommunications; data processing; and web search portals and information services.'

ICT sector (Eurostat). A more selective definition of the ICT sector used by Eurostat categorises ICT manufacturing and ICT services using NACE three-digit groups ([25]) as follows.

ICT manufacturing:

- 26.1 – manufacture of electronic components and boards;
- 26.2 – manufacture of computers and peripheral equipment;
- 26.3 – manufacture of communication equipment;
- 26.4 – manufacture of consumer electronics;
- 26.8 – manufacture of magnetic and optical media.

([25]) https://ec.europa.eu/eurostat/cache/metadata/en/isoc_se_esms.htm#shortref_areaDisseminated.

ICT services:

- 46.5 – wholesale of information and communications equipment;
- 58.2 – software publishing;
- 61 – telecommunications;
- 62 – computer programming, consultancy and related activities;
- 63.1 – data processing, hosting and related activities; web portals;
- 95.1 – repair of computers and communication equipment.

Telecommunications sectoral social dialogue committee (SSDC). This is a subset of the Eurostat definition of the ICT services sector indicated above: 58.2 (software publishing), 61 (telecommunications, be they wired, wireless, satellite or other), 62 (computer programming, consultancy and related activities) and 63.1 (data processing, hosting and related activities; web portals).

In addition to the varieties of different sectoral definitions using NACE, researchers must address the practical issue that there are different levels of sectoral detail available in survey data. For many Eurostat data sources, including the EU-LFS and SES microdata, sector is only captured at the one-digit level (namely information and communication – Section J) or at an intermediate level between one and two digits. This limits the possibility of using some of the operational definitions indicated above, which rely on three-digit NACE data (for example, NACE 63.1 mentioned above). There are workarounds involving EU-LFS data published on the Eurostat website and ad hoc extraction requests kindly provided on request by Eurostat colleagues, which allow a greater level of detail (generally at the level of NACE two-digit divisions), but these are always in the form of aggregated data.

Occupational classification of IT

The analysis in this report relies on the current ISCO-08, which serves as the harmonised framework for labour market data on occupations across the EU. Data on occupation using ISCO tend to be available in much more detail in microdata (three and four digit). This allows us to identify workers with IT skill sets more precisely, regardless of the sector in which they work. It is also an occupational categorisation of IT workers that is the basis of the relevant EU-level policy target: the Digital Decade 2030 objective that the EU-27 should have 20 million 'ICT specialists' by 2030.

ICT specialists are defined by Eurostat as workers 'who have the ability to develop, operate and maintain ICT systems' and for whom ICT constitutes 'the main part of their job' (OECD, 2004).

This definition is currently operationalised with a categorisation of the following ISCO four-digit occupational group.

I – ICT managers, professionals and associate professionals

133 ICT service managers

25 Information and communications technology professionals

251 Software and applications developers and analysts

2511 Systems analysts
2512 Software developers
2513 Web and multimedia developers
2514 Application programmers
2519 Software and applications developers and analysts not elsewhere classified

252 Database and network professionals

2521 Database designers and administrators
2522 Systems administrators
2523 Computer network professionals
2529 Database and network professionals not elsewhere classified

35 Information and communications technicians

351 ICT operations and user support technicians

3511 ICT operations technicians
3512 ICT user support technicians
3513 Computer network and systems technicians
3514 Web technicians

352 Telecommunications and broadcasting technicians
3521 Broadcasting and audio-visual technicians
3522 Telecommunications engineering technicians

II – Other unit groups that primarily involve the production of ICT goods and services

2152 Electronic engineers
2153 Telecommunication engineers
2166 Graphic and multimedia designers
2356 Information technology trainers
2434 ICT sales professionals
3114 Electronics engineering technicians
742 Electronics and telecommunications installers and repairers
7421 Electronics mechanics and servicers
7422 ICT installers and servicers

Sources: Eurostat metadata (https://ec.europa.eu/eurostat/cache/metadata/en/isoc_skslf_esms.htm#shortstat_popDisseminated); see also OECD (2019) and López Cobo et al. (2020).

The population of 'ICT specialists' can be captured using the two main survey sources that we rely on in this report, the EWCS and Eurostat's EU-LFS.

While ISCO-08 provides a robust basis for longitudinal comparison, it is important to note certain limitations regarding its ability to capture emerging specialisations within the ICT domain. Owing to the age of the current classification – developed in the early 2000s and operational since 2008 – many modern ICT specialisations, including those of cybersecurity managers or machine learning / AI specialists do not have a dedicated four-digit ISCO code. National statistical offices – and Eurostat – typically map these roles into the most relevant existing categories based on the primary nature of the tasks performed and in accordance with the 'functional similarity' principle established by the International Labour Organization (International Labour Office, 2012).

Experts in AI and machine learning are likely to be classified under ISCO 2512 (software developers) or ISCO 2511 (systems analysts) (Squicciarini et al., 2021; OECD, 2023). When roles involve highly novel applications that do not align with traditional programming definitions, they are frequently assigned to ISCO 2519 (software and applications developers and analysts not elsewhere classified). Specialised cybersecurity roles are distributed according to functional seniority. Strategic and departmental roles are typically captured under ISCO 1330 (information and communications technology service managers), while technical security engineering and architecture are often assigned to ISCO 2529 (database and network professionals not elsewhere classified).

The growth observed in 'not elsewhere classified' categories – specifically ISCO 2519 and ISCO 2529 – should be interpreted as a proxy for the diversification and increasing specialisation of the IT workforce. Rising employment in these categories reflects the emergence of roles that post-date the 2008 framework. Much of the rapid recent employment growth in ISCO 2519 (see Table 1) and ISCO 2529 may be attributable to demand for AI and cybersecurity expertise.

ICT specialist job titles (ERM). The analysis of the ERM events in Chapter 3 covers restructuring cases in IT. The main screening included selecting cases from the ICT sector as defined by Eurostat above, based on the NACE codes of sectors recorded in the ERM database. In addition, the screening covers restructuring cases outside the ICT sector, if their description explicitly involves ICT specialists, in line with the Eurostat–OECD definition reported above. In order to capture possible variations in the names of the occupations, a large language model was prompted to produce a list of job titles associated with these occupations. In addition, since some announcements do not provide very detailed professions, a list of some broader and generic words was also added, namely 'IT roles'.

The full list of ICT specialist job titles used for screening ERM cases is as follows: IT roles, IT professionals, ICT specialists, IT developers, IT programmers, software developers, computer network professionals, applications developers, database professionals, graphic designers, multimedia designers, electronic engineers, cybersecurity specialists, cybersecurity engineers, data engineer, cloud specialists, cloud engineers, ICT installers, web developers, back-end engineers, front-end engineers, full-stack developers, software architects, mobile developers, database developers, network administrators, hardware installation technicians, software installation technicians, computer user support specialists, IT support technicians, DevOps engineers, DevOps architects, AI engineers, mobile applications developers, systems analysts, machine learning engineers, AI specialists, IT security analysts, information security analysts, network engineers, systems administrators, cloud solutions architects, IT consultants, IT auditors, penetration testers, ethical hackers, quality assurance engineers, test automation engineers, user interface designers,

user experience designers, platform engineers, site reliability engineers, IT operations specialists, IT infrastructure engineers, IT service desk analysts, IT compliance specialists, blockchain developers, product owners, internet of things engineers, augmented reality developers, virtual reality developers, cybersecurity analysts, cloud security engineers, security operations centre (SOC) analysts, prompt engineers, natural language processing engineers, robotics process automation developers, technical product managers and embedded systems engineers.

Data on the IT sector and occupations used in this report

This report uses both a sectoral and an occupational lens to analyse both employment and quality of work trends of IT workers, depending on the granularity available in different data sources.

Where data allow, we use the 'ICT specialist' occupational category, which is based on a collection of granular ISCO four-digit occupations. Where it does not, we use either the broader occupational categories, notably 'ICT professional' (ISCO 25), or relevant sectoral categories, notably 'information and communication' (NACE Section J) and 'computer programming, consultancy and related activities' (NACE 62). Table A1 gives an overview of the various data sources and the granularity they provide for occupation (ISCO) and sector (NACE).

Table A1: Overview of various data sources and granularity

Data source	Granularity	Category used in report
EU-LFS microdata	ISCO two/three digits NACE one digit	ICT professional (ISCO 25) Information and communication (NACE Section J)
Eurostat website	ISCO two digits NACE two digits	ICT professional (ISCO 25) Computer programming, consultancy and related activities (NACE 62)
Ad hoc extractions	ISCO four digits NACE two digits	ICT specialist
ISOC_E	Enterprise size (small, medium, large)	ICT specialist
EWCS	ISCO four digits	ICT specialist
SES	ISCO two digits NACE one digit	ICT professional (ISCO 25) Information and communication (NACE Section J)
Job vacancy statistics	NACE one digit	Information and communication (NACE Section J)
ERM	NACE two digits Job titles derived from ISCO four digits	ICT sector / ICT specialists
LinkedIn	LinkedIn industries	TIM (equivalent to information and communication – NACE Section J)

In practice, there is a significant degree of overlap between these categories, and for most outcomes trends are similar, with only modest differences in estimates.

Annex 2: Note on the Structure of Earnings Survey data

The 2022 SES statistics refer to enterprises with at least 10 employees in the areas of economic activities defined by NACE Revision 2, Sections B–S, excluding Section O. Sectors excluded are public administration, activities of extraterritorial organisations and bodies, agriculture and activities of households as employers. However, the inclusion of earnings data in public administration is optional, as is the inclusion of enterprises with fewer than 10 employees. Some countries provide data for both smaller employing entities (< 10) and public administration employees.

The basis of the published Eurostat gender pay gap estimates is the mandated coverage: employment units with 10 or more employees in Sectors B–S, except Sector O. SES microdata do not allow the precise identification of employer size in all Member States with respect to the 10-employee threshold, which means that the gender pay gap estimate for the occupation of ICT professional in Figure 23 may not be strictly comparable to the estimates for all employees and the information and communication sector (NACE Section J). The 2022 SES microdata made available to researchers also do not include data for the following Member States: Austria, Denmark, Ireland and Slovenia.

Annex 3: Short thematic questionnaires sent to the Network of Eurofound Correspondents (2025)

Improving labour supply in IT: labour shortages

a. What indicators/sources currently provide the most reliable evidence about the extent and nature of labour shortages in the information and technology sector within your country? What do they indicate?
b. What are the main causes of shortages (rapid demand growth, inadequate training, brain-drain (to other adjacent, IT-using, higher-paid sectors; to other countries)?
c. Where are shortages particularly acute – in terms of location, of occupational profile and in terms of specific skillsets?
d. Are there data or reliable sources/references on the extent to which the IT sector relies on the following as supplementary sources of labour supply:
    a. intra-EU mobility;
    b. third-country workers;
    c. virtual work including cross-border virtual work?
e. If available, outline one policy – or organisation initiative – raising female participation in ICT roles (provisions, budget, implementation, evidence of impact/effectiveness, for e.g. from evaluation studies).
f. If available, outline one policy – or organisation initiative / management practice – successfully addressing IT sector labour shortages (provisions, budget, implementation, evidence of impact/effectiveness, for e.g. from evaluation studies).

IT clusters

a. Are there specific clusters of IT sector activity in your country? Identify regions/cities and give estimates of headcount employment (in absolute and relative terms – e.g. % share of regional employment), where possible broken down at NACE 3-digit level.
b. Identify the main IT specialisations in these clusters (e.g. software development, AI/genAI, cloud, cybersecurity, outsourced IT services etc).
c. What is the split between indigenous and foreign-headquartered firms in the IT clusters identified – or in the sector nationally, if data only available at the national level?
d. What policies or factors have been most important in supporting the formation or strengthening of IT clusters in your country? To what extent has the interaction between public investment, universities, research institutes and industry influenced the development and success of IT clusters or specialisation areas?
e. Based on expert feedback and relevant data, would you consider these clusters established or novel/emerging? Fast, moderate or slow growing?
f. How do stakeholders view the competitiveness of the national IT sector as well as the clusters identified above? Comparators: (regions /clusters in) other EU member states or the US/Asia.

Recent trends in social dialogue in IT

a. With reference to Eurofound (2019), can you briefly indicate whether there is any update on the main unions and employer organisations active in representing interests on the workers' and employers' side in your country – basic details: names of organisations, membership.

b. What is the current level of trade union membership and collective bargaining coverage in the IT sector in your country? How does this compare to the national average across all sectors? What are the trends? Is trade union membership / collective bargaining coverage increasing, stable or decreasing?

c. Where levels are significantly lower than national averages, can you indicate which factors are most important in explaining these low levels? (for example, company culture, employee demographics, attitudes towards unions …).

d. How effective has social dialogue been in addressing employment issues related to restructuring in the IT sector?

e. Are there examples of employers actively cooperating with or resisting efforts at collective representation of workers? Can you provide examples and details?

f. Are trade unions from other sectors (e.g. telecommunications, finance, manufacturing, public sector …) actively organising IT workers or attempting to represent their interests? If yes, please give examples of such initiatives and discuss their effectiveness.

Country coverage

Questionnaire responses were received from the following members of the Network of Eurofound Correspondents (September/October 2025) (Table A2).

Table A2: Questionnaire responses from the Network of Eurofound Correspondents

Member State	Correspondent	Labour shortages	Social dialogue	IT clusters
Austria	Hannah Quinz			
Bulgaria	Vassil Kirov			
Croatia	Predrag Bejaković			
Czechia	Soňa Veverková			
Denmark	Christoffer Madsen			
Estonia	Miriam Lehari			
Finland	Vera Lindström			
France	Frédéric Turlan			
Germany	Thilo Janssen and Sandra Vogel			
Greece	Elena Kousta			
Hungary	Nóra Krokovay			
Ireland	Andy Prendergast			
Italy	Alessandro Smilari			
Lithuania	Inga Blažienė			
Malta	Luke Fiorini			
Netherlands	Thomas de Winter			
Portugal	Maria Lima			
Romania	Stefan Guga			
Slovakia	Miroslava Kordošová			
Spain	Iñigo Isusi			
Sweden	Elina Härmä			
Total		**19**	**12**	**12**

Network of Eurofound Correspondents centres in Belgium, Cyprus, Latvia, Luxembourg, Poland and Slovenia did not participate in this on-request exercise.

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Information technologies are general-purpose technologies with positive productivity spillovers across our economies and societies. The expanding possibilities of artificial intelligence, increasing cybersecurity threats and the importance of the EU developing its digital independence and 'sovereignty' underline their significance. The EU has set itself the objective of having 20 million information and communications technology specialists in employment by 2030. While employment in information technology is growing much faster than employment overall, labour shortages abound, especially in more specialised roles. This report addresses the challenges for the digital workforce around employment and quality of work that need to be confronted if the EU-27 is to realise its ambitious digitalisation targets.

The European Foundation for the Improvement of Living and Working Conditions (Eurofound) is a tripartite European Union Agency established in 1975. Its role is to provide knowledge in the area of social, employment and work-related policies according to Regulation (EU) 2019/127.

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