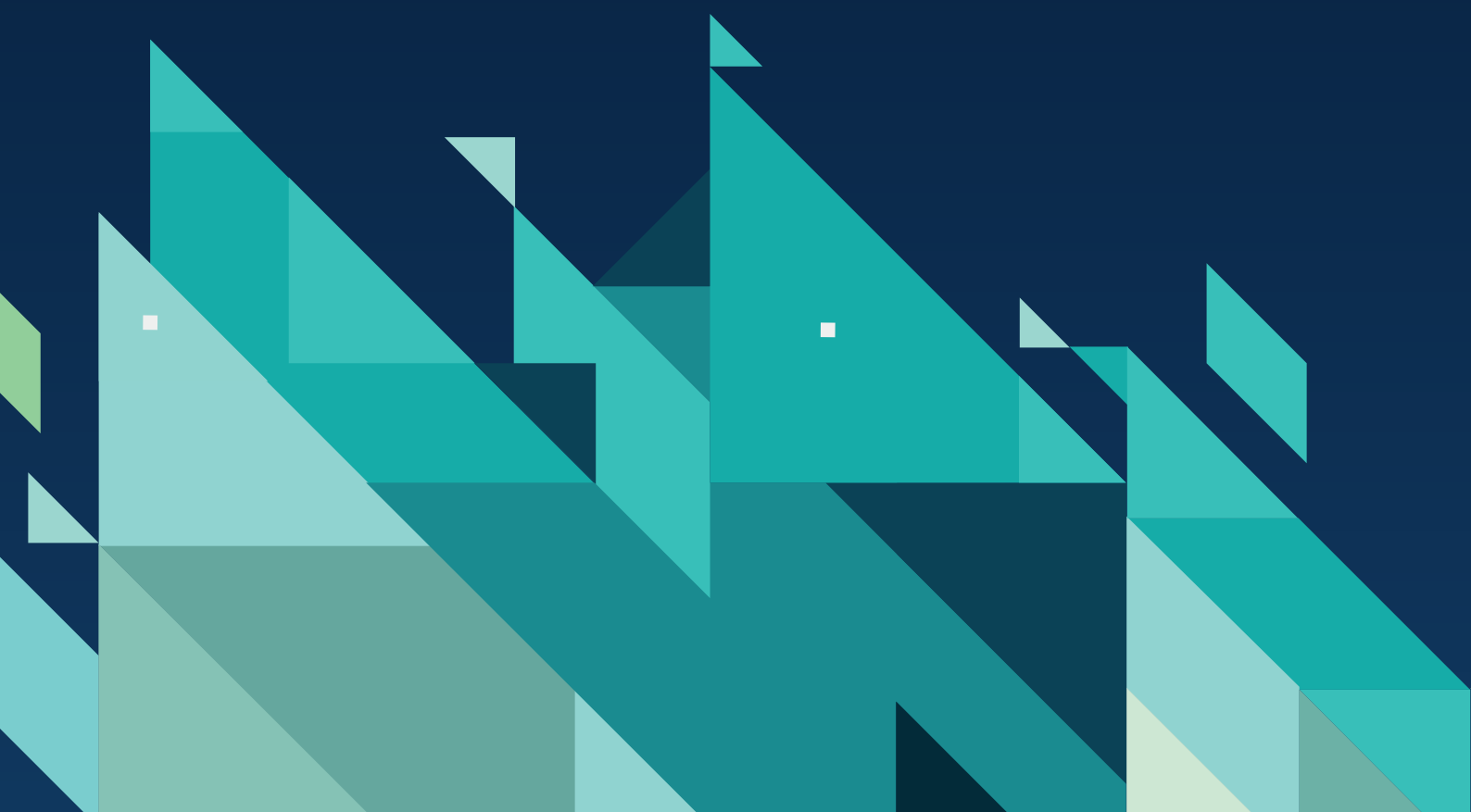


Measuring changing competency requirements in Irish digital occupations: Evidence from online job vacancies

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Table of contents

Executive summary.....	vii
Chapter 1 Introduction.....	1
Chapter 2 Literature review	4
Chapter 3 Data and descriptives.....	8
3.1 Data 	8
3.2 Identifying digital occupations	10
3.3 Vacancy characteristics	17
Chapter 4 Skill changes and composition analysis.....	21
4.1 Most demanded basic and specialised skills	21
4.2 Skill change analysis	24
4.2.1 Methodology.....	24
4.2.2 Results	26
4.3 Skill composition analysis	31
4.3.1 Methodology.....	31
4.3.2 Results.....	32
4.4 Demand for artificial Intelligence	40
Chapter 5 Task change and technological change: Evidence from the ESJS.....	44
5.1 Methodology	44
5.2 Results	45
Chapter 6 Discussion and workshop insights	51
Chapter 7 Conclusions	54
References 	59
Appendix 	61

List of tables

Table 3.1	Summary of datasets	9
Table 3.2	Digital occupations, employment share and digital index score (2021)	15
Table 3.3	Number of vacancies posted in digital occupations Ireland and EU-27, 2021 and 2024	19
Table 4.1	Categorisation of basic and specialist digital skills using Lightcast.....	22
Table 4.2	Most demanded basic digital skills (Ireland, digital occupations, 2021 and 2024)	23
Table 4.3	Most demanded specialised digital skills (Ireland, digital occupations, 2021 and 2024)	24
Table 4.4	Digital skill change values (digital occupations, Ireland, 2021–2024)	27
Table 4.5	Most frequently demanded skills, 2024.....	33
Table 4.6	Skills with stable demand between 2021 and 2024	34
Table 4.7	Skills with emerging demand between 2021 and 2024	35
Table 4.8	Skills with declining demand between 2021 and 2024	36
Table 5.1	Descriptive on technological change and task change, 2021, EU-27.....	46
Table 5.2	Probit model predicting the probability of experiencing various forms of task change arising from new technologies, 2021, EU-27.....	48
Table 5.3	Multinomial logit results predicting the probability of experiencing various forms of task change arising from new technologies, 2021, EU-27.....	50
Table A1	ICT service managers: Most important, emerging, declining and stable skills (Ireland, 2021 and 2024)	61
Table A2	Engineering professionals (excluding electrotechnology: Most important, emerging, declining and stable skills (Ireland, 2021 and 2024)	63
Table A3	Electrotechnology engineers: Most important, emerging, declining and stable skills (Ireland, 2021 and 2024)	65
Table A4	Software and applications developers and analysts: Most important, emerging, declining and stable skills (Ireland, 2021 and 2024)	67
Table A5	Database and network professionals: Most important, emerging, declining and stable skills (Ireland, 2021 and 2024).....	69

Table A6	Process control technicians: Most important, emerging, declining and stable skills (Ireland, 2021 and 2024)	71
Table A7	Information and communications technology operations and user support technicians: Most important, emerging, declining and stable skills (Ireland, 2021 and 2024)	73
Table A8	The most common job titles in information and communications technology service managers	75
Table A9	The most common job titles in engineering professionals (excluding electrotechnology).....	75
Table A10	The most common job titles in electrotechnology engineers.....	76
Table A11	The most common job titles in software and applications developers and analysts.....	76
Table A12	The most common job titles in database and network professionals	76
Table A13	The most common job titles in process control technicians	77
Table A14	The most common job titles in information and communications technology operations and user support technicians	77
Table A15	Finance professionals: Most important, emerging, declining and stable skills (Ireland, 2021 and 2024)	78
Table B1	ICT specialists, Eurostat classification	82
Table B2	ISCO descriptions	83
Table B3	Digital occupations, european and Irish digital index score (2021).....	86
Table B4	Wald tests by occupation class, across tech change category pairs	87

List of figures

Figure 3.1	Methodological approach for identifying digital occupations	17
Figure 4.1	Digital skill change values (digital occupations, Ireland, 2021–2024)	28
Figure 4.2	Positive and negative digital skill change values (digital occupations, Ireland, 2021–2024).....	29
Figure 4.3	Digital skill change values (digital occupations, Ireland and EU-27, 2021–2024)	30
Figure 4.4	Positive and negative digital skill change values (digital occupations, Ireland and EU-27, 2021–2024).....	31
Figure 4.5	Incidence of ‘AI’ and ‘artificial intelligence’ in Irish Job advertisements	42
Figure A1	Digital skill change values (digital occupations, Ireland and EU-27, 2021–2024) (including finance professionals)	80
Figure A2	Positive and negative digital skill change values (digital occupations, Ireland and EU-27, 2021–2024) (including finance professionals)	81

Abbreviations

AI	Artificial Intelligence
CAE	Computer-aided engineering
DFHERIS	Department of Further and Higher Education, Research, Innovation and Science
ESCO	European Skills, Competences, Qualifications and Occupations
ESJS	European Skills and Jobs Survey
ESRI	Economic and Social Research Institute
FDI	Foreign direct investment
GenAI	Generative artificial intelligence
ISCO	International Standard Classification of Occupations
JDII	Job digital intensity index
TCD	Trinity College Dublin

Executive summary

This research was funded by the Irish Department of Further and Higher Education, Research, Innovation and Science (DFHERIS). The study focuses on labour market demand for key digitally intensive occupations in Ireland, employing a large-scale international vacancy dataset to analyse changing competency requirements. It is important to note that the scope of this study is focused on core ICT professionals and roles where advanced digital skills are the primary function of the job (such as software developers, network engineers and ICT technicians), rather than general knowledge workers who may use digital tools.

Using a large-scale international dataset of online job vacancies, we examine how employer competency requirements in these roles evolved between 2021 and 2024. Specifically, we investigate how the demand for technical competencies, both basic and specialised, has been changing between 2021 and 2024, a period that has been associated with the emergence of more rapid artificial intelligence (AI) adoption in the workplace. To provide international context, we benchmark Ireland's trends against the European Union (EU-27) average. Our analysis categorises shifts in key digital skills demand into three distinct areas:

- **Stable skills:** Competencies that remained in consistently high demand in both 2021 and 2024;
- **Emerging skills:** Competencies that were rarely required in 2021 but rose in importance by 2024;
- **Declining skills:** Competencies that were highly sought after in 2021 but experienced a marked drop in employer demand in 2024.

To achieve this, the study adopts a multi-source empirical approach, combining quantitative job advertisement and survey data with qualitative insights from stakeholder consultations. Furthermore, the core analyses are based on the systematic selection of seven key digitally intensive occupations. The timeframe chosen, from 2021 to 2024, is of particular importance as it captures the early labour market dynamics before and immediately following the widespread public release of advanced generative AI tools (such as ChatGPT in late 2022).

The introduction of these models to the general public and digital industries led to increased AI adoption, leading to greater public and policy debate regarding the immediate future of workplace skill requirements.

Our results show that the relative share of digital occupation vacancies over total number of vacancies has been decreasing over 2021 and 2024, both in Ireland and in the EU-27. In Ireland, the share decreased from 24.2 per cent to 18.4 per cent, while in the EU-27 it fell from 16.4 per cent to 11.7 per cent. Despite this decline, digital occupations continued to account for a larger proportion of vacancies in Ireland than across the EU-27 in 2024. In terms of the absolute number of vacancies, vacancies in digitally intensive occupations in Ireland remained stable over the 2021–2024 period, at approximately 140,000; however, vacancy numbers varied across individual digital occupations. For instance, the number of vacancies for engineers increased from 46,885 to 60,356 vacancies, while for software developers it declined from 57,553 to 41,912 between 2021 and 2024. In contrast to the relatively stable trend in Ireland, the number of digital occupation vacancies across the EU-27 increased by 13 per cent between 2021 and 2024. Overall, while demand for digital occupations grew more strongly across the EU-27 in absolute terms, digital occupations continued to represent a larger share of total vacancies in Ireland. The decline in the relative share in both Ireland and the EU suggests that vacancies in non-digital occupations grew more rapidly than those in digital occupations between 2021 and 2024.

Our analysis on the most demanded basic and specialised skills across all digital occupations shows that the most commonly required skills have remained stable over the 2021–2024 period. With respect to basic digital competencies, the top five most demanded skills saw little change between 2021 and 2024, with over 70 per cent of adverts requesting ‘basic computer literacy’ and the ‘ability to use Microsoft Office’. With respect to specialised skills, the five most demanded competencies were relatively stable over the period. ‘Business ICT systems’ and ‘computer programming’ were the most demanded competencies in both 2021 and 2024. There was some decline in the demand for ‘ability to use software design’ patterns and ‘administer ICT systems’. There was no evidence of rapid growth in any particular specialised competency, when measured across all digitally intensive occupations, over the 2021 to 2024 period. The skill requirement

analysis at the detailed occupational level aligns with our aggregate findings. Statistically, the most prevalent trend is an apparent stability in the broad skill categories requested; however, qualitative feedback suggests this surface-level continuity likely masks growing complexity within the tasks themselves. Where explicit statistical changes occurred, declining skills were more prevalent than emerging ones. The most frequently demanded specialised skills across all digital occupations in 2024 were ‘programming’, ‘knowledge of business ICT systems’, ‘database management’ and ‘knowledge of data processing’. Therefore, despite intense public and media attention on the transformative potential of AI, machine learning and generative AI (GenAI), our findings show no evidence of large-scale changes in employer skill demand, at least in the short run. Rather than a rapid entry of newly emerging skills, the data over this period demonstrate a steady, incremental evolution in competency requirements.

To further investigate these dynamics, we conduct a skill composition analysis, which systematically evaluates the magnitude and direction of changing skill demand to identify stable, emerging and declining skills within digital occupations vacancies over time. Results show that there was a higher rate of stability among the basic skills that were demanded between 2021 and 2024 relative to specialist skills. A wide range of basic competencies largely related to the use of Microsoft Office software remained stable over the period, while stable specialist skills were ‘programming’, ‘data processing skills’ and ‘business ICT systems’.

Relatively few competencies saw consistent increases of five percentage points or more in their relative vacancy shares over the 2021 to 2024 period (emerging skills). In terms of specialist skills, the demand for ‘ICT infrastructure’ skills became more dominant in four of the seven digital occupations, while the use of ‘CAE software’, ‘database’ and ‘Visual Studio .NET’ skills increased in importance in up to three digital occupations.

The number of declining specialist skills greatly outweighed the number of declining basic skills. The demand for skills related to ‘software configuration management’ and ‘web programming’ declined in three of the seven occupations, while the demand for ‘CSS’ and ‘SAP’ skills declined in three occupations. Additionally, a range of other specific legacy tools and advanced digital skills experienced

falling demand across a minority of the selected occupations. This apparent contraction may reflect the natural life cycle of specific software packages and/or the consolidation of these granular tasks into broader, more complex skill architectures, rather than a genuine reduction in the technical expertise required by employers.

When the skill composition for each digital occupation was examined individually, the patterns remained consistent with the aggregate analysis. The most demanded specialised skills remained highly stable over the 2021 to 2024 period; where changes occurred, decrease in demand for skills was more common than an increase in demand. However, observed changes were relatively modest and no major shifts in the demand for particular skills were observed at the detailed occupational level.

To complement the skills analysis, we also examine the specific job titles posted by employers. The analysis of the job titles most related to the seven digital occupational categories reveals that, in general, there is a large amount of heterogeneity in the job titles associated with digital occupations, and that this remains relatively consistent over the 2021 to 2024 period. The ten largest job titles occupations typically accounted for between approximately 20 and 30 per cent of total vacancies within each occupational category.

We also utilise employee-level data from the 2021 European Skills and Jobs Survey (ESJS) to investigate the extent to which employees in digitally intensive occupations in Europe were impacted by new technologies in their jobs, and the extent to which these new technologies impacted their job task requirements. Approximately 57 per cent of employees in digitally intensive occupations experienced the introduction of new technologies in their jobs in the previous year, compared to between 27 per cent and 46 per cent for other less digitally intensive job categories. Moreover, compared to other job categories, we find that individuals in the seven digitally intensive occupations had a lower probability of experiencing new technology introduction in their jobs with no impact on tasks. However, they also report higher probabilities that new technologies will (i) create new tasks only or (ii) simultaneously create and destroy tasks.

Building on this quantitative evidence, in our consultation workshop with representatives of employers, educationalists and other relevant

bodies, participants reported their view that, while there has been stability in most of the commonly required skills among digitally intensive occupations, and decline in the demand for other skills, the meaning of some of the skill terms used within job advertisement data is likely to have changed substantially over the time under study. Specifically, it was felt that many of the actual skill requirements associated with terms used in the adverts became more complex over the period and are now encompassing more competencies.

Chapter 1

Introduction

As the nature of work evolves, the skills required by employers change over time. This change can happen at varying rates, depending on differing characteristics associated with specific jobs. This might be particularly relevant for digitally intensive occupations – those in which workers perform a high level of digital tasks – for which the pace of technological development is recognised to be occurring at a much faster pace than was previously the case. For example, the diffusion of artificial intelligence (AI) may have greater implications for the required skills associated with software developers than it might have for caterers.

When skill requirements change, workers are required to up- or re-skill (i.e. via education or training) in order to secure desirable employment. Change in occupational competency requirements also has important implications for education and training providers who seek to match curricula to the evolving needs of employers. Given that changes to skills provision and training takes time, and skill change happens continuously, the likelihood of the existence of sufficiently skilled labour is lower in jobs where skill change happens more quickly. In other words, potential skills shortages and gaps are more likely to occur in jobs that experience more rapid changes in tasks.

Ireland's ability to provide skilled labour in occupations requiring advanced digital skills has been a key element in its ability to attract high value added foreign direct investment (FDI) over recent decades and, by extension, has undoubtedly contributed extensively to the nation's prosperity. It is essential that sufficient labour market intelligence systems (i.e. the data infrastructure and analytical tools used to track, classify and forecast skill demand across occupations) are developed to ensure that Ireland continues to keep pace with the evolving demand for advanced digital skills. This paper contributes to that infrastructure by analysing real-time job advertisements data, offering a granular and timely picture of digital skill demand.

This report utilises a large-scale international vacancy dataset to analyse the labour market demand for key digitally intensive occupations in Ireland over the last few years. For clarity, the scope of this analysis is focused on core digital occupations where the

application of digital skills is the primary objective of the work. Specifically, it investigates how the demand for technical competencies, both basic and specialised, changed between 2021 and 2024, a period that also saw the emergence of more rapid AI adoption in the workplace. The study also benchmarks the extent of labour market change in these dimensions against the EU average. The study aims at identifying key digital skills that were demanded by employers in 2021 but experienced a marked decline in importance by 2024 (declining skills), and also those competencies that were not evident in 2021 job adverts but had risen to prominence by 2024 (emerging skills). The study also identifies the digital skills that were in high demand in both 2021 and 2024 (stable skills).

Therefore, in order to systematically investigate the evolving nature of digital skills in Ireland, this study addresses the following core research questions within the chapters of this report:

- How has the absolute demand and relative share of job vacancies in key digitally intensive occupations in Ireland evolved between 2021 and 2024, and how does this compare to the EU-27 average? (*Chapter 3*)
- Which specific basic and specialised technical skills have remained stable, emerged, or declined within these digital occupations over this time period? (*Chapter 4*)
- To what extent are employees in these digitally intensive roles exposed to technological change, and how does the introduction of new technologies impact their daily task composition (for example, task creation versus task destruction)? (*Chapter 5*)
- How do the empirical trends observed in vacancy data align with the experiences and perceptions of industry and education stakeholders regarding skill consolidation and the integration of emerging technologies like AI? (*Chapter 6*)

Overall, the research adopts an empirical approach, combining large-scale international vacancy data with European skills surveys. This quantitative analysis is supplemented by a targeted stakeholder consultation, which serves to validate and contextualise the empirical trends and findings, providing a more comprehensive overview of the labour market for digitally intensive occupations in Ireland relative to the EU-27.

The report is structured as follows: Chapter 2 begins with a review of the literature concerning technological change. Chapter 3 outlines the methodological framework used to identify digitally intensive occupations and to track their changing requirements, while introducing the three key datasets employed: the Lightcast international job advertisement dataset, the European Labour Force Survey (EU-LFS), and the European Skills and Jobs Survey (ESJS). Chapter 4 then examines the changing skill composition within these roles, providing an in-depth analysis of stable, emerging and declining basic and specialised technical competencies between 2021 and 2024. Chapter 5 broadens the analysis by utilising employee-level data from the ESJS to investigate the impacts of introducing new technologies on the daily task composition of workers within these digital occupations. Chapter 6 examines stakeholders' perceptions of the changing digital labour market in order to validate our quantitative findings and to further investigate these trends via qualitative data. This chapter addresses perspectives from employers and educators regarding the consolidation of technical skills, the rising importance of adaptability and the practical implications of AI adoption. Finally, Chapter 7 concludes with a comprehensive summary of our findings and their implications for future skills policy.

Chapter 2

Literature review

The relationship between technological change, labour demand and the skills required by workers has been studied extensively in economics. Early theoretical frameworks characterised technological change as skill-biased, complementing high-skilled workers while substituting for low-skilled workers (Katz and Autor, 1999; Acemoglu, 2002). Autor et al. (2003) subsequently developed a task-based account of technological change, arguing that automation primarily substitutes for routine tasks. Under this framework, middle-skilled workers performing routine tasks were most exposed, while non-routine manual and cognitive tasks were relatively less affected. This helped explain the process of job polarisation, whereby employment became increasingly concentrated at the upper and lower ends of the skill distribution, with a hollowing out of mid-skilled occupations. More recent work has argued that artificial intelligence (AI) may again reshape the allocation of tasks across workers and occupations, potentially affecting both high-skilled and middle-skilled work in ways that differ from earlier waves of automation (Autor, 2024).

Recent research has focused increasingly on newer forms of technological change, including AI, advanced automation, cloud computing, data analytics and related digital tools. Some of these technologies, particularly AI and advanced automation, differ from earlier waves of automation because they are increasingly capable of performing non-routine cognitive tasks, including information ordering, perceptual speed and deductive reasoning. As a result, recent AI-related technologies may expose high-skilled knowledge workers more directly than earlier forms of automation, although digital transformation also affects demand for a wider set of technical, organisational and complementary skills (OECD, 2023). Within the AI-focused literature, Cazzaniga et al. (2024) argue that the implications for workers depend not only on exposure to AI, but also on the extent to which AI complements rather than substitutes existing skills. A related, more granular strand of this literature identifies the specific tasks generative AI is best suited to perform. For example, Eloundou et al. (2023) find programming and writing tasks show particularly high exposure to large language models, while Eifeldt et al. (2023) distinguish between exposure through an occupation's core tasks, tied to substitution, and exposure through supplemental tasks, tied to

complementarity. Occupations with high exposure and low complementarity may face greater risks of task or job displacement, while occupations with high exposure and high complementarity may experience productivity gains, provided workers have the skills required to use these technologies effectively. Autor (2024), focusing specifically on AI, also suggests that AI may allow workers with more modest formal skill levels to perform tasks previously reserved for specialists, potentially creating more equalising effects than earlier forms of automation.

A rapidly growing literature uses real-time job advertisement data scraped from online vacancy portals to examine how employer skill requirements are changing. These data have several advantages over traditional survey sources: they are large-scale, timely and provide direct evidence on employer demand, rather than relying on self-reported worker characteristics (Sostero and Fernández-Macías, 2021; Cedefop, 2025). Vacancy data are particularly useful for studying digital transformation in the labour market, especially within digital occupations where recruitment is predominantly conducted online and where skill requirements can change quickly. However, representativeness remains an important limitation, as online postings may underrepresent some segments of the labour market, particularly lower-skilled roles. This concern is less acute in the present study, which focuses on digital occupations that are more likely to be advertised through online channels.

Recent evidence from vacancy data points to substantial changes in the skills demanded by employers. Jaumotte et al. (2026) show that approximately one in ten job postings in advanced economies now requires at least one skill that was rare a decade earlier, highlighting the pace at which skill requirements are evolving. Their analysis also emphasises that increasing the supply of skilled workers is not sufficient on its own, and that firms must also be able to adopt and use digital skills effectively. Related evidence suggests that digital skills carry measurable labour market value. Garcia-Lazaro et al. (2025) find that employers reward digital skill requirements in posted wages, including within occupations, indicating that digital competencies are associated with wage premiums even among otherwise similar jobs. While some of this recent evidence focuses specifically on AI, the broader implication is that digital transformation is changing not only

the level of demand for digital workers, but also the mix of competencies required within occupations.

A number of studies have applied vacancy data to examine skill demand in digitally intensive and emerging technology occupations. Borgonovi et al. (2023) use Lightcast vacancy data for 14 OECD countries to identify clusters of AI-related skills demanded by employers, finding that while technical competencies such as machine learning are central, non-technical and relational skills are also frequently required. The OECD (2022) similarly uses online vacancy data across ten countries to identify the skills most in demand in occupations central to the digital transition, applying machine learning methods to vacancy text. In the Irish context, Whelan et al. (2024) examine skill requirements for emerging technologies, using online job advertisements to study demand across areas such as AI, blockchain and automation.

In Ireland, the supply of workers with advanced digital skills has been central to attracting high-value foreign direct investment (FDI) and supporting economic growth. Ireland has also been an early adopter of digital technologies by international standards. For example, Ireland recorded the highest share of enterprises using AI among European countries in 2020, at approximately 23 per cent (Eurostat, 2021), although AI should be viewed as one component of a broader digital transformation rather than the sole driver of changing skill demand. Building on this strong baseline of enterprise adoption, the period from 2021 to 2024 saw a significant acceleration in the integration of these technologies. Driven largely by the mainstream rollout of generative AI models in late 2022 and 2023, digital industries experienced an increased diffusion of new capabilities in areas such as automated code generation, data analysis and language processing. This specific technological shock provides context for examining whether, and to what extent, employers' actual demand for digital skills shifted in response to the availability of these new tools. At the same time, recent research suggests that Irish jobs are highly exposed to emerging technologies, in terms of both potential task replacement and task transformation. Qualitative evidence from Irish employers in emerging technology fields also indicates that demand is not limited to narrow technical expertise. Employers emphasise the importance of combining technical skills with soft skills, adaptability and a positive attitude to lifelong learning (Bukartaite and Hooper, 2023). The

regulatory environment may further intensify skill needs, as developments such as the EU Artificial Intelligence Act 2024 create demand for organisational capabilities in compliance, governance and risk management.

Despite this growing evidence base, relatively little research has systematically examined how the specific digital skill requirements within established digital occupations are changing over time. Much existing work focuses either on broad exposure to new technologies or on newly emerging technology roles, rather than on changes in the composition of skills demanded within existing digital occupations. Where changes in skill composition have been studied, declining skills have often been found to be more common than emerging ones, and the pace of change appears more gradual than some public discussion of AI-driven disruption would suggest.

The present study contributes to this literature by providing detailed occupation-level evidence on changing digital skill demand in Ireland between 2021 and 2024, benchmarked against EU-27 trends. Using a consistent vacancy-based methodology, the analysis identifies stable, emerging and declining competencies within each digital occupation. This allows the study to distinguish between occupations where skill demand is relatively stable and those where employers' requirements are shifting more substantially. In doing so, the paper provides evidence on how digital occupations are evolving in practice, and on the specific competencies that may require attention from education, training and skills policy.

Chapter 3

Data and descriptives

This chapter outlines the datasets and methodologies employed to examine the labour market for digitally intensive occupations in Ireland. It details the use of the European Labour Force Survey (EU-LFS) and the European Skills and Jobs Survey (ESJS) to systematically identify and classify key digital occupations based on employment shares, digital task intensity and the occupation description. Furthermore, utilising a comprehensive international vacancy dataset from Lightcast, the chapter presents a descriptive analysis of job posting patterns, comparing vacancy characteristics and occupational demand in Ireland against EU-27 averages for the period between 2021 and 2024.

3.1 Data

In this study, data are used from a range of sources. To identify the most digitally intensive occupations and outline the classification used thorough the report, we employ 2021 EU-LFS data for Ireland, along with the 2021 wave of the European Skills and Jobs Survey (ESJS2). The ESJS data are also used to investigate the impact of technological change on tasks of employees in digitally intensive occupations (see Chapter 5). To assist the reader in navigating the multiple data sources employed in this report, Table 3.1 provides a summary mapping of each dataset to its primary analytical purpose and corresponding chapters.

Table 3. 1 Summary of datasets

Dataset	Scope	Use	Chapter
European Labour Force Survey (EU-LFS)	Ireland, 2021	To identify employment shares and size of key digital occupations	Chapter 3
European Skills and Jobs Survey (ESJS, Wave 2)	EU-27, 2021	To construct the job digital intensity index, the JDII, and to analyse the impact of technological adoption on daily task composition	Chapters 3 and 5
Lightcast vacancy data	Ireland and EU-27, 2021 and 2024	To analyse online job posting patterns, job titles and the changing composition of basic and specialised digital skill requirements	Chapters 3 and 4

Source: Authors' elaboration.

The EU-LFS is a large-scale household survey representative of EU households, administered by Eurostat, reporting on labour participation of people aged 15 and over, with information on a variety of individual and job characteristics, and labour market status. Eurostat harmonised the Labour Force Surveys of each EU Member State in order to produce comparable statistics.

The ESJS2 is the second wave of the survey administered by Cedefop.¹ It is a comprehensive and representative employee-based survey on adult employees aged 24 to 65 in EU countries, plus Iceland and Norway. The survey collects information on employees' sociodemographic characteristics (i.e. gender, age, occupation, sector, tenure), as well as detailed job characteristics on skill requirements and task content, working arrangements, wages and job satisfaction.

The bulk of the report's analysis is devoted to investigating the labour market demand, skill requirements and skill composition of digitally intensive occupations employing job advertisement data from Lightcast. Lightcast collects online job vacancies from a wide range of

¹ Cedefop (European Centre for the Development of Vocational Training) is a decentralised EU agency; it supports the European Commission, EU Member States and social partners in developing and implementing vocational education and training (VET), skills and qualifications policies.

platforms, using sophisticated digital tools, and parses them into data suitable for analysis. These data contain the near-universe of online job vacancies posted internationally.

The vacancies contain information such as job title, job description, dates posted/expired, occupation type, sector, company identifiers, skill, experience, education requirements and, where available, posted salary ranges.

Online job advertisement data make for a valuable source of information for profiling labour demand, particularly for digital occupations. While the use of online job platforms for advertising vacancies may not be the norm across all occupations, their use is certainly widespread among digital occupations in Ireland. As such, online job vacancies are likely to be strongly representative of true labour demand for digital skills, especially for our selected occupations. For our study, we focus on job vacancies posted in digital occupations in Ireland in 2021 and 2024. We select these years for two reasons. First, 2021 aligns with the collection period for the ESJS2, which we used to help select our digital occupations. Therefore, we examine how the skill requirements of jobs that were digital in 2021 have changed over time. Second, we select 2024 as it is the latest complete year of data that is available at the time of writing.

3.2 Identifying digital occupations

In this section we explain how we identified and classified the key digitally intensive occupations within the ISCO occupational framework at an ISCO 3-digit level in Ireland.²

To date, there is no single, standardised European classification that comprehensively defines digital occupations. This is a limitation for the purpose of our research. However, Eurostat and the OECD provide a

2 For more information about the ISCO framework, please see: <https://ilostat.ilo.org/methods/concepts-and-definitions/classification-occupation/>.

jointly agreed definition of ICT specialists and a statistical operationalisation of ICT specialist occupations via ISCO codes.³

As a basis for our identification strategy, we anchor our analysis on the Eurostat/OECD definition of ICT specialists, which represents the most established classification of digitally intensive occupations at EU level so far, and then we include further identification steps to better capture digitally intensive occupations for Ireland.⁴

Table B1 in the appendix provides the list of ISCO occupations classified as ICT specialists from Eurostat, which includes ICT managers, professionals and associate professionals and other occupations primarily involved in producing ICT goods and services. Eurostat identifies 3-digit and 4-digit occupations that are primarily located among the following seven ISCO 2-digit occupational categories:

1. **ISCO 13:** Production and specialised services managers
2. **ISCO 21:** Science and engineering professionals
3. **ISCO 24:** Business and administration professionals
4. **ISCO 25:** Information and communications technology professionals
5. **ISCO 31:** Science and engineering associate professionals
6. **ISCO 35:** Information and communications technicians
7. **ISCO 74:** Electrical and electronics trades workers.

In our study, we aim to capture ICT specialist occupations from a broader perspective, potentially capturing occupations that are not strictly ICT specialist roles but are high digitally intensive. To do so, we select each ISCO 3-digit occupational category within the seven 2-digit ICT specialist categories listed above. We aim to examine ISCO 3-digit occupations that are (i) of importance in terms of employment size for Ireland and (ii) clearly digital intensive in nature. To implement the first step, we extract 2021 employment shares using EU-LFS data for Ireland. To implement the second step, we construct a digital intensity index within the ESJS2 data to identify occupations with a high degree

³ Eurostat defines ICT specialists as ‘workers who have the ability to develop, operate and maintain ICT systems, and for whom ICT constitute the main part of their job’.

⁴ Please, see:
https://ec.europa.eu/eurostat/cache/metadata/en/isoc_skslf_esms.htm.

of digital specialisation; moreover, we analyse the ISCO occupational titles and their descriptions to select the most digitally intensive ones.

We measure digital task intensity within occupations for 27 EU countries using the ESJS2.⁵ We identify occupations with substantial digital task content using the following question in the ESJS2, which is asked of those who say they use any sort of computing device (phone/tablet/laptop/desktop computer) as part of their job:

Did you use any of the computing devices mentioned earlier to do the following activity as part of your main job in the last month?

- Use the internet for browsing, sending emails or using social media for your work;
- Write or edit text, for instance using Word or similar software;
- Prepare presentations of your work, for instance using PowerPoint or similar software;
- Use spreadsheets, for instance using Excel or similar software;
- Use more advanced functions of spreadsheets, for instance macros or complex formulas;
- Work with specialised sector- or occupation-specific software, for instance for accounting, legal analysis, inventory control, web design, graphic design, customer relationship management, etc.;
- Manage and merge databases, for instance using Access, Oracle or similar software, and related query techniques (e.g. SQL);
- Write programs or code using a computer language, for instance C++, Python, Java, Visual Basic, etc.;
- Write programs using artificial intelligence (AI) methods, for instance machine-learning or deep-learning algorithms;
- ‘Develop or maintain IT systems, hardware or software.’⁶

⁵ EU-27 less Cyprus and Malta, plus Iceland and Norway.

⁶ Asked conditionally only if respondent answered yes to 8.

For empirical clarity, we group these tasks into three categories based on their complexity and the level of digital proficiency required.

Following Cedefop's own categorisation (Cedefop, 2022), we use the following definitions:

Basic technology use: Internet browsing, word processing, presentation preparation and simple spreadsheet work.

Intermediate technology use: More complex spreadsheet operations (e.g. using macros), working with specialised occupation-specific software and managing databases.

Advanced technology use: Programming, use of AI or machine learning methods, and IT system development or maintenance.

We then construct a job digital intensity index (JDII), which accounts for the digital tasks that employees perform as part of their job and weighs tasks based on their complexity, in order to measure the digital intensity of a job. According to the JDII, each basic task an employee does is assigned a weight of one, each intermediate task is assigned a weight of two and each advanced task is assigned a weight of three. An employee's JDII score is the sum of the weights of the individual tasks they perform. This index then represents a continuous measure of employee digital intensity, ranging from zero to nineteen. We calculate the JDII for all of the selected 3-digit occupations at an EU level (Table 3.2, Column 2) and for the Irish digital occupations (Table 3.2, Column 3) where the sample size allows.⁷

In Table 3.2, we list the 20 3-digit occupations underlying the ISCO 2-digit occupations; we provide their employment size and the JDII score.

⁷ Advanced tasks contribute more to an employee's digital intensity score than intermediate tasks, and intermediate tasks contribute more than basic digital tasks. Even when we construct a more complex alternative index using principal component analysis (PCA) to derive task weights (where PCA is applied to the vector of individual binary task indicators reported by workers, and the first principal component is extracted), the correlation between the two indices remains extremely high ($R \approx 0.98$). As such, we have chosen to use the baseline additive index in our main analysis as it is more intuitive and easier to comprehend.

The full official description of each occupational category is presented in Appendix Table B2.

From these 20 occupations, we select 7 (highlighted in bold) that we assess as having high digital content, based on the JDII and their ISCO titles and descriptions, and a significant share of employment in Ireland. Note that some occupations have been excluded based on their detailed ISCO description (see Appendix B2). Although these occupations may involve the use of digital tools and have a significant employment share, they were not judged to be strictly digital in nature.

The first thing to note is that the digital occupations selected account for approximately 7 per cent of total employment in Ireland in 2021.⁸ We can see from the European JDII that the JDII for the seven selected occupations is on average higher than the occupations that were not selected.

⁸ There is evidence of an error in the coding of the Irish LFS: There are zero ‘database and network professionals’ across any year, while this occupation does exist in the rest of Europe’s LFS data. This seems like an error, as we know these occupations exist in Ireland from the Lightcast data where over 1,000 advertisements existed in 2021. Also, a much larger share of employees are classified as broad ‘ICT professionals’, but are classified neither as software analysts nor as network professional in Ireland than anywhere else in the EU. As such, what we believe happened is that network professionals are included in the ‘unclassified ICT professionals’ for Ireland. Therefore, to be able to make comparisons between Ireland and Europe in terms of labour share, we have combined software analysts (ISCO251), network professionals (ISCO252) and unclassified ICT professionals (ISCO250) into a single category to calculate labour share in 2021. We believe it is still justified to look at 251 and 252 separately in Lightcast as the sample is large enough that the skill change values seem to differ. Labour share of network professionals in Europe (population weighted) in 2021 was 0.33 per cent and software analysts was 1.48 per cent, while software analysts in Ireland was 1.67 per cent and network professionals was 0 per cent.

Table 3.2 Digital occupations, employment share and digital index score (2021)

ISCO code	ISCO 3-digit occupation	LFS share (Ireland)	Digital index score (all EU-27 countries)
133	ICT service managers	0.20%	12
251	Software and applications developers and analysts	3.10%	11.9
252	Database and network professionals	3.10%	10.5
351	ICT operations and user support technicians	1.00%	10
215	Electrotechnology engineers	0.40%	8.8
241	Finance professionals	2.60%	7.7
214	Engineering professionals (excluding electrotechnology)	2.20%	7.7
243	Sales, marketing and public relations professionals	1.40%	7.6
242	Administration professionals	2.30%	7.2
216	Architects, planners, surveyors and designers	0.70%	7
213	Life science professionals	0.60%	6.9
211	Physical and engineering science technicians	1.30%	6.4
312	Mining, manufacturing and construction supervisors	0.20%	6.2
313	Process control technicians	0.20%	4.8
741	Electrical equipment installers and repairers	0.90%	4.4

Source: Employment shares are calculated from the 2021 EU-LFS; the digital index score is calculated using the 2021 ESJS.

Note: In the EU-LFS data for Ireland, software and applications developers and analysts, and database and network professionals are assigned to the same category. As such, their employment shares are equal and not separate. In Table B3 in the appendix we also report scores of the JDII calculated using only the Irish sample size. Because of small sample size for several occupations, we employ the European JDII for the main purpose of our analysis.

Therefore, throughout the present report, ‘digital occupations’ refers to the following final selected list of ISCO 3-digit digital occupations:⁹

1. **ISCO 133:** Information and communications technology service managers
2. **ISCO 214:** Engineering professionals (excluding electrotechnology)
3. **ISCO 215:** Electrotechnology engineers

⁹ For ease of exposition, we refer to these categories as ICT managers, engineers (excluding electrotechnology), electrotechnology engineers, software developers, database professionals, process control technicians and ICT technicians accordingly herein and where appropriate.

4. **ISCO 251:** Software and applications developers and analysts
5. **ISCO 252:** Database and network professionals
6. **ISCO 313:** Process control technicians
7. **ISCO 351:** Information and communications technology operations and user support technicians.

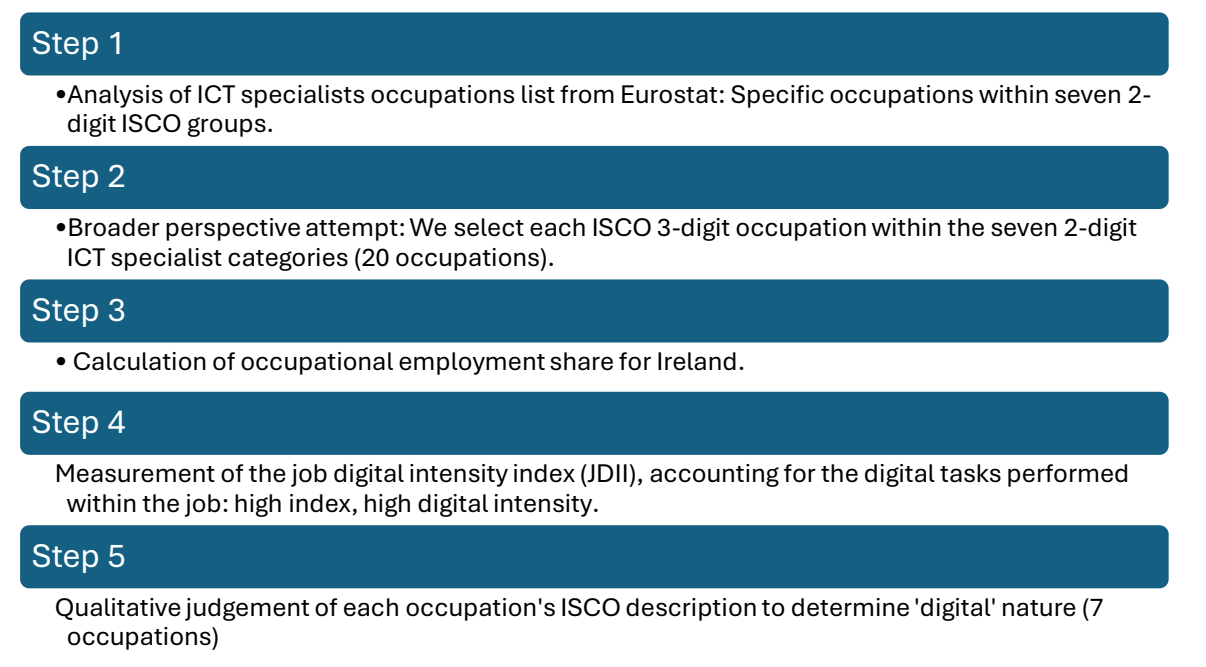
It is important to acknowledge several limitations related to our approach. First of all, there is no single, officially agreed taxonomy for identifying digital occupations at the EU level. The most authoritative available anchor, the Eurostat/OECD definition of ICT specialists, is operationalised through a specific set of ISCO codes and captures only occupations for which ICT constitutes the main part of the job. By design, this definition excludes a broader set of occupations in which digital tools and skills are used intensively but do not constitute the occupation's primary function.

To address this, we constructed a job digital intensity index (JDII) intended to capture such occupations, extending our analysis beyond the strict ICT specialist definition and analysing the broad ISCO 2-digit categories related to the occupations identified by Eurostat. However, the selection of which occupations to include, beyond ICT specialists, necessarily involved an element of subjective judgement. Nonetheless, our digital intensity index analysis reassuringly revealed that the prior selection of the broad ICT specialist 2-digit occupations did not result in any exclusion of other occupations located at the higher tail of the JDII distribution: excluded 2-digit occupations have lower digital intensity scores compared to included 2-digit occupations.

Second, and separately, once the index had been computed, the selection of which occupations to classify as 'digital' and which to exclude required an additional interpretive step, based on qualitative judgement of each occupation's ISCO description. We acknowledge this subjectivity as a limitation of our study: while our index is grounded in measurable criteria, the underlying classification challenge means that alternative, equally defensible choices of inclusion criteria might yield somewhat different occupational boundaries. We view this as an inherent limitation of working in an area where official statistical classifications have not yet caught up with the pace and pervasiveness of digitalisation, rather than a shortcoming specific to our methodology. To assist the reader in navigating the information

provided, Figure 3.1 provides a summary of all steps followed in our methodology.

Figure 3.1 Methodological approach for identifying digital occupations



Source: Authors' elaboration.

3.3 Vacancy characteristics

In this section, we analyse job posting patterns and vacancy characteristics for digital occupations in Ireland in 2021 and 2024 (see Table 3.3). The number of overall vacancies in digital occupations remained stable over 2021–2024, at approximately 140,000; however, there were some more variations within occupations. For instance, the number of vacancies for engineers increased from 46,885 to 60,356 while vacancies for software developers declined from 57,553 to 41,912 between 2021 and 2024.

In order to assess the extent to which the trends in vacancies observed are country specific or part of a general international trend, we compare the job posting patterns in Ireland with the EU-27 average.¹⁰ While digital occupation vacancies were static in Ireland over the 2021 to 2024 period, they increased by 13 per cent across the EU-27. However, while digital occupations accounted for 18.4 per cent of all vacancies in Ireland in 2024, the comparable figure for the EU-27 in 2024 was 11.7 per cent. Thus, while there was a higher growth in digital occupation vacancies across the EU-27

¹⁰ Note that the results for the EU-27 aggregate presented in this report are sourced from McGuinness et al. (2026).

over the 2021 to 2024 period, digital occupations as a share of total vacancies remained much higher in Ireland in 2024 relative to the EU-27 average. It is worth noting that the share of digital occupations vacancies over total number of vacancies was higher in 2021 than in 2024, both in Ireland and in the EU-27, signalling that the share of non-digital occupation jobs as a share of total jobs was higher in 2024 compared to 2021.

Table 3.3 Number of vacancies posted in digital occupations Ireland and EU-27, 2021 and 2024

ISCO 3-digit occupation	Vacancies (2021)	Vacancies (2024)	Percentage change	Share of total vacancies (2021)	Share of total vacancies (2024)	Percentage point difference, 2021 and 2024
<i>Ireland</i>						
Database professionals	10,344	9,532	-7.80%	1.80%	1.30%	-0.50
Electrotechnology engineers	7,652	8,114	6.00%	1.30%	1.10%	-0.20
Engineers (excl. electrotechnology)	46,885	60,356	28.70%	8.10%	7.90%	-0.20
ICT technicians	10,062	8,765	-12.90%	1.70%	1.20%	-0.50
ICT managers	4,194	5,325	27.00%	0.70%	0.70%	0.00
Process control technicians	4,018	5,763	43.40%	0.70%	0.80%	0.10
Software developers	57,553	41,912	-27.20%	9.90%	5.50%	-4.40
Total	140,708	139,767	-0.70%	24.20%	18.40%	-5.80
<i>EU-27</i>						
Database professionals	448,629	400,728	-10.70%	1.80%	1.00%	-0.80
Electrotechnology engineers	147,811	186,617	26.30%	0.60%	0.50%	-0.10
Engineers (excl. electrotechnology)	1,179,099	1,676,905	42.20%	4.80%	4.30%	-0.50
ICT technicians	285,721	309,782	8.40%	1.20%	0.80%	-0.40
ICT managers	96,825	163,771	69.10%	0.40%	0.40%	0.00
Process control technicians	20,511	28,471	38.80%	0.10%	0.10%	0.00
Software developers	1,887,794	1,852,908	-1.80%	7.60%	4.70%	-2.90
Total	4,066,390	4,619,182	13.60%	16.40%	11.70%	-4.70

Source: Lightcast, authors' elaboration.

We further characterise jobs that are located among digital occupations. Lightcast data contain a variable denoting the job title that is listed in each online vacancy. We leverage this variable to characterise the job titles that are most common within the seven digital occupational categories and are therefore most likely to be affected by identified changes in skill demand over time; we will present this in the next section. Tables A8–A14 in the appendix report the most common job titles in each occupational category in 2024 and their corresponding incidence in 2021 and 2024.

In general, we find that there is a large amount of heterogeneity in the job titles associated within digitally intensive occupations, and that these remain relatively consistent over the 2021 to 2024 period. The ten most frequently occurring job titles typically accounted for between approximately 20 and 30 per cent of total vacancies within each occupation. The exception is the electrotechnology engineers grouping, where the ten largest job titles accounted for 44 per cent of total vacancies; this was predominantly driven by the job title ‘electrical engineer’, which accounted for approximately 20 per cent of vacancies within the category of electrotechnology engineers in both 2021 and 2024.

Overall, the descriptive analysis presented in this section highlights a relatively stable absolute demand for digital occupations in Ireland between 2021 and 2024, despite a slight decrease in their share of total vacancies. Furthermore, while there is heterogeneity in the specific job titles within these overarching occupational categories, the core roles driving digital employment in Ireland remain highly consistent. This analysis sets the foundation for a more detailed examination of their underlying skill compositions, presented in Chapter 4.

Chapter 4

Skill changes and composition analysis

This chapter provides a detailed analysis of the changing competency requirements within the seven identified digital occupations between 2021 and 2024. By leveraging the detailed skills taxonomy within the Lightcast vacancy dataset (as coded by the European Skills, Competences, Qualifications and Occupations (ESCO) taxonomy), we evaluate aggregate and occupation-specific shifts in employer demand for both basic and specialised technical competencies. The analysis applies a composite measure of occupational skill change to quantify the magnitude and direction of these shifts. In addition, we examine the skills that rose the most in demand (i.e. ‘emerging skills’), as well as those that fell substantially over time (i.e. ‘declining skills’) to evaluate which types of skills are becoming more (less) relevant to each digital occupational category. Furthermore, we profile ‘stable’ digital skills – those skills that are both important (i.e. highly demanded) and for which demand has been consistent over time.

4.1 Most demanded basic and specialised skills

In this section, we investigate how the demand for technical competencies, both basic and specialised, required by employers in key digitally intensive occupations has been changing between 2021 and 2024. Lightcast data contain the specific skills (as coded by the ESCO taxonomy) that are required in each vacancy. Using this information, we aggregate the demand for each skill within each digital occupation for both 2021 and 2024. We are primarily focused on digital skills; therefore, we employ a categorisation of ESCO skills operated by Lightcast. Lightcast classifies ‘hard’ skills into four skill categories according to Lightcast categorisation: 1) basic information skills, 2) information brokerage skills, 3) ICT technical skills and 4) applied/management informatic skills. We analyse only skills related to these categories. This approach allows us to remove competencies that do not necessarily require training resources (i.e. transversal skills such as communication, organisation skills, time management). For interpretability, we assign skill categories to ‘basic’ or ‘specialised’ groups; basic information skills and information brokerage skills are assigned to the ‘basic’ skill group, while ICT technical skills and applied/management informatic skills are assigned to the ‘specialised’

skill group. Examples of the competencies categorised under the approach are provided in Table 4.1.

Table 4.1 Categorisation of basic and specialist digital skills using Lightcast

Skill category	Examples	Basic / specialised
Basic information skills	Use Microsoft Office, have computer literacy	Basic
Information brokerage skills	Social media marketing techniques, graphic editor software	Basic
ICT technical skills	Web programming, JavaScript	Specialised
Applied informatic skills	Natural language processing, CAD software	Specialised

Source: Lightcast, authors’ elaboration.

We show the most demanded basic and specialised digital skills in 2024 across digital occupations in Tables 4.2 and 4.3. The first thing to note is that the most commonly requested basic and specialist skills have remained very stable over the 2021–2024 period. With respect to basic digital competencies, the top five most demanded skills saw little change between 2021 and 2024, with over 70 per cent of adverts requesting basic ‘computer literacy’ and the ‘ability to use Microsoft Office’. There was some decline in the demand for the ‘ability to use spreadsheet software’, from 30.3 to 23.9 per cent of vacancies. Conversely, the demand for competencies in the ‘use of creative suite software’ increased somewhat from 6 per cent of vacancies in 2021 to 11.4 per cent of vacancies in 2024.

With respect to specialist skills, the most demanded five competencies were relatively stable over the period. ‘Business ICT systems’ and ‘computer programming’ were the most demanded competencies in both 2021 and 2024. There was some decline in the demand for ‘ability to use software design patterns’ and ‘administer ICT systems’. There was no evidence of rapid growth in any particular

specialist competency, when measured across all digitally intensive occupations, over the 2021 to 2024 period.¹¹

Table 4.2 Most demanded basic digital skills (Ireland, digital occupations, 2021 and 2024)

Skill	Appearances (2021)	Appearances (2024)	% vacancies (2021)	% vacancies (2024)
Have computer literacy	107,549	105,364	76.4%	75.4%
Use Microsoft Office	102,644	101,874	72.9%	72.9%
Use Office systems	40,145	37,390	28.5%	26.8%
Excel	36,751	35,523	26.1%	25.4%
Use spreadsheets software	42,616	33,407	30.3%	23.9%
Office software	25,776	25,029	18.3%	17.9%
Hardware components	20,897	21,395	14.9%	15.3%
Use creative suite software	8,480	15,879	6.0%	11.4%
Use Word processing software	14,837	14,123	10.5%	10.1%
Use query languages	14,437	10,081	10.3%	7.2%
Total vacancies	140,708	139,767		

Source: Lightcast, authors' elaboration.

¹¹ Note that we also checked whether the changes in vacancy shares for the specific most demanded skills between the two time periods under study are statistically significant. Two-proportion z-tests confirmed that all changes in skill vacancy shares between 2021 and 2024 are statistically significant at the 5 per cent level, reflecting the large sample sizes.

Table 4.3 Most demanded specialised digital skills (Ireland, digital occupations, 2021 and 2024)

Skill	Appearances (2021)	Appearances (2024)	% vacancies (2021)	% vacancies (2024)
Business ICT systems	99,224	93,294	70.5%	66.7%
Computer programming	77,744	70,895	55.3%	50.7%
Database	45,542	47,809	32.4%	34.2%
Analyse software specifications	42,113	38,725	29.9%	27.7%
Use software design patterns	38,148	36,517	27.1%	26.1%
Use object-oriented programming	42,403	32,949	30.1%	23.6%
Process data	28,628	31,504	20.3%	22.5%
Administer ICT system	35,718	24,544	25.4%	17.6%
Cloud technologies	24,941	22,990	17.7%	16.4%
ICT system programming	23,027	22,769	16.4%	16.3%
Total vacancies	140,708	139,767		

Source: Lightcast, authors' elaboration.

4.2 Skill change analysis

4.2.1 Methodology

In this section, we characterise the most significant changes in skill requirements for each digital occupation. For each digital occupation, we compare the most demanded skills in 2021 to those demanded in 2024. This allows us to evaluate whether the profile of the most important skills has changed over time.

Due to the scale of Lightcast data and the number of unique skills captured in it, this analysis is limited to examining a non-exhaustive list of skill requirements (i.e. the top ten most demanded / rising / falling skills). We thereby risk missing underlying trends in the vacancy data that may manifest outside of these limited data points. We account for this by calculating a composite, aggregate measure of occupational skill change, based on work from Deming and Noray (2020), Acemoglu et al. (2022) and Kelly et al. (2025). This approach allows us to examine the magnitude and direction of changing skill demand for each occupation, giving us a sense of which jobs have changed the most (least), and the extent to which skill emergence or skill obsolescence

plays a role in these changes. Our occupational skill change measure is outlined in Equation 1.

$$SkillChange_o = \sum_{s=1}^S Abs \left(\frac{Skill_{s,o,2024}}{Vacancies_{o,2024}} - \frac{Skill_{s,o,2021}}{Vacancies_{o,2021}} \right) \quad (1)$$

In which *Skill* denotes the number of times skill *s* is required in the vacancies posted for occupation *o* in the year of interest (i.e. 2021 or 2024). *Vacancies_o* denotes the number of vacancies posted for the occupation of interest. For example, suppose we examine software and applications developers and analysts in Ireland. If the skill ‘Python’ appeared in 70 per cent of vacancies for this occupation in 2021, and appeared in 40 per cent of vacancies in 2024, the absolute difference would be 0.3 (30 percentage points) over time, and so would add as much to the *SkillChange_o* value. *SkillChange_o* is therefore the aggregated absolute difference in skill demand between 2021 and 2024 for occupation *o*. As such, *SkillChange* captures the extent to which the skill profile of vacancies in each digital occupation is different across years. Higher values of *SkillChange* are attributable to occupations where many skills that were strongly demanded in one year are not strongly demanded in the other; *Skillchange* increases with both skill emergence and skill obsolescence over time. Employing these two analytical approaches allow us to (i) characterise the most important skills in each occupation, (ii) assess whether certain skills are stable, increasing or decreasing in demand over time and (iii) give an overall assessment of the magnitude and direction of skill change in each occupation over time.

Jobs can change due to the emergence of new skills, the destruction and obsolescence of old skills, or, more likely, a combination of both. In its current form, *SkillChange_o* does not differentiate between skills that have emerged and/or risen in demand over time, or declined and/or become entirely obsolete. As stated earlier, high values of *SkillChange_o* could be driven by high rates of skill demand increases and/or high rates of skill demand decreases. To account for differences in the direction of skill demand trends over time, we draw on work from Acemoglu et al. (2022) and estimate *PositiveSkillChange_o* and *NegativeSkillChange_o*, defined in Equations 2 and 3.

$$PositiveSkillChange_o = \max \left\{ \sum_{s=1}^S Abs \left(\frac{Skill_{s,o,2024}}{Vacancies_{o,2024}} - \frac{Skill_{s,o,2021}}{Vacancies_{o,2021}} \right), 0 \right\} \quad (2)$$

$$NegativeSkillChange_o = -\min \left\{ \sum_{s=1}^S Abs \left(\frac{Skill_{s,o,2024}}{Vacancies_{o,2024}} - \frac{Skill_{s,o,2021}}{Vacancies_{o,2021}} \right), 0 \right\} \quad (3)$$

If demand for a given skill s has risen over time, the simple difference in the percentage of demand is added to *PositiveSkillChange_o*.

However, if demand for a skill has remained unchanged or decreased over time, then a zero is added to *PositiveSkillChange* for that skill (i.e. the skill does not contribute to variation in the occupational value).

The opposite is the case for *NegativeSkillChange_o*; only negative skill change values contribute to the negative aggregate measure.

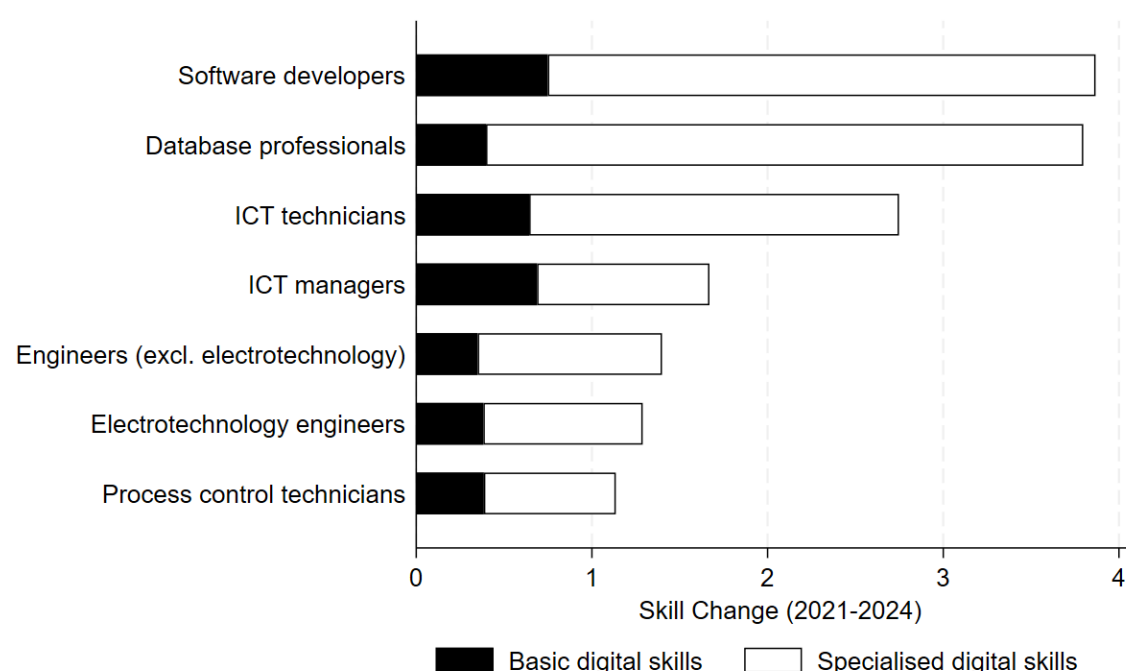
4.2.2 Results

We begin by examining aggregate trends in the magnitude and direction of the absolute *SkillChange* measure in digital occupations in Ireland (according to Equation 1). To do this, we report the *SkillChange* values, as well as the portions of total *SkillChange* that are attributable to basic and specialised skills, for the seven digital occupations in Ireland – see Table 4.4 and Figure 4.1 below. Across all digital occupations, most of the changes in skill demand are attributed to specialised skills, rather than basic digital skills.

Table 4.4 Digital skill change values (digital occupations, Ireland, 2021–2024)

ISCO 3-digit occupation	Skill change (total)	Skill change (basic skills)	Skill change (specialised skills)
Database and network professionals	3.797	0.397	3.400
Electrotechnology engineers	1.288	0.382	0.907
Engineering professionals (excluding electrotechnology)	1.399	0.350	1.049
ICT operations and user support technicians	2.748	0.643	2.105
ICT service managers	1.670	0.688	0.981
Process control technicians	1.136	0.385	0.751
Software and applications developers and analysts	3.868	0.749	3.118

Source: Lightcast, authors' calculations.

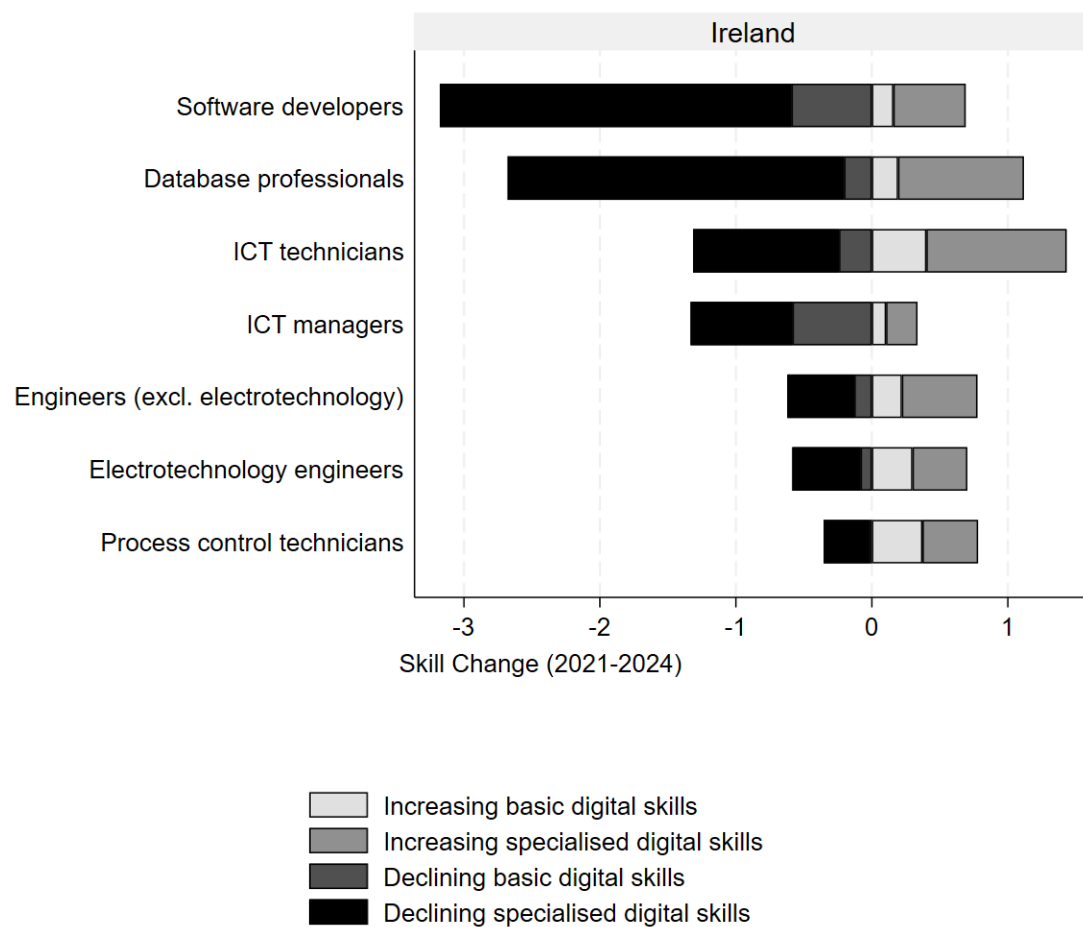
Figure 4.1 Digital skill change values (digital occupations, Ireland, 2021–2024)

Source: Lightcast, authors' calculations.

Note: ISCO 3-digit categories are slightly relabelled here for ease of interpretability.

We calculate both positive and negative skill change values for the seven digital occupations outlined previously (according to Equations 2 and 3). Again, we distinguish between basic and specialised digital skills. We report the values for each occupational category in Figure 4.2. For software and applications developers and analysts, database and network professionals and ICT managers, the majority of skill change was driven by the decline in demand for specialised digital skills. For software and applications developers and analysts, database and network professionals, almost two-thirds of changes in digital skill demand can be attributed to reduction in demand for specialised skills, while the equivalent figure is approximately 45 per cent for ICT managers. For process control technicians, engineering professionals, electrotechnology engineers and ICT technicians, the skill change trends are more balanced: the aggregate increases in skill demand are approximately equal to the aggregate decreases, signalling a general 'churn' in skill demand.

Figure 4.2 Positive and negative digital skill change values (digital occupations, Ireland, 2021–2024)



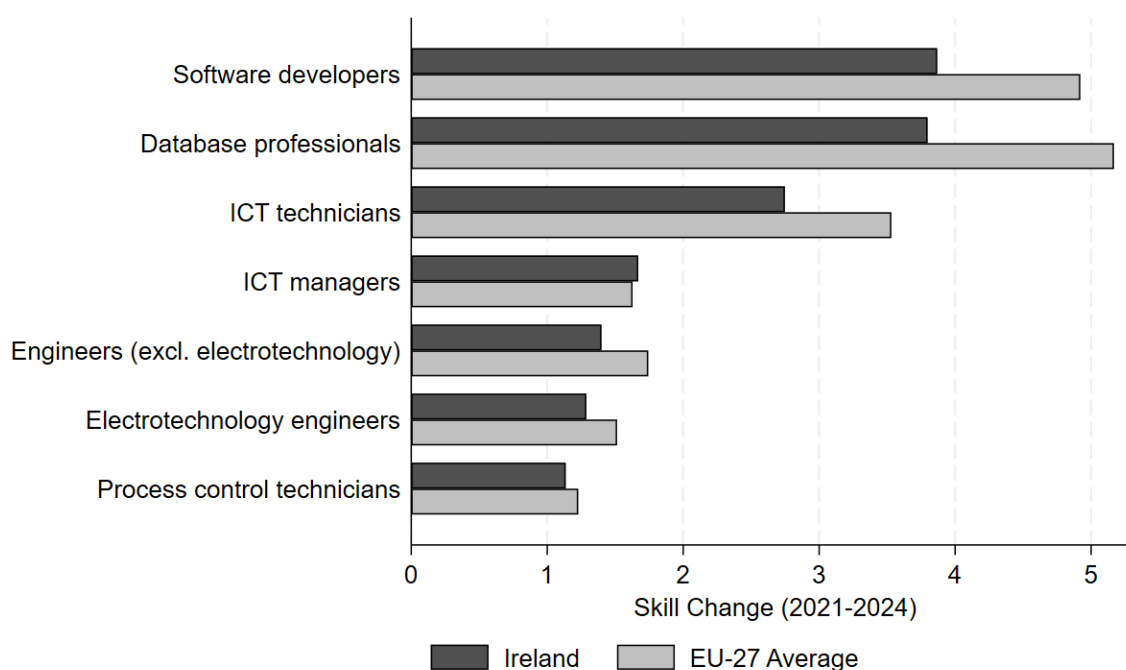
Source: Lightcast, authors' calculations.

Note: ISCO 3-digit categories are slightly relabelled here for visualisation purposes.

Given that our aggregate skill change measures are relative, it is difficult to assess the magnitude of skill change within digital occupations in Ireland over time. In other words, it is unclear whether the skill change we observe is high or low. We therefore compare the *SkillChange* values for the digital occupations in Ireland to the equivalent values calculated for occupations across the EU-27. To do this, we calculate *SkillChange* (as well as the positive and negative variants) for the digital occupations for each EU-27 Member State, and compute the 2024 population-weighted average of *SkillChange* for each occupational category. We compare these values in Figure 4.3. In general, digital occupations in Ireland have experienced lower levels of skill requirement changes when compared to the EU-27 average

between 2021 and 2024, with the only exception being ICT service managers, where the figures were broadly comparable. One potential explanation for this divergence is the specific structural composition of Ireland's digital economy. Ireland has a notably high concentration of digital employment within a relatively small number of large, established multinational technology companies. The core competency requirements and technical architectures within these large-scale enterprises may be more stabilised, and thus slower to undergo rapid, fundamental shifts compared to the more fragmented, SME-driven digital sectors that make up a larger portion of the broader EU-27 average.

Figure 4.3 Digital skill change values (digital occupations, Ireland and EU-27, 2021–2024)



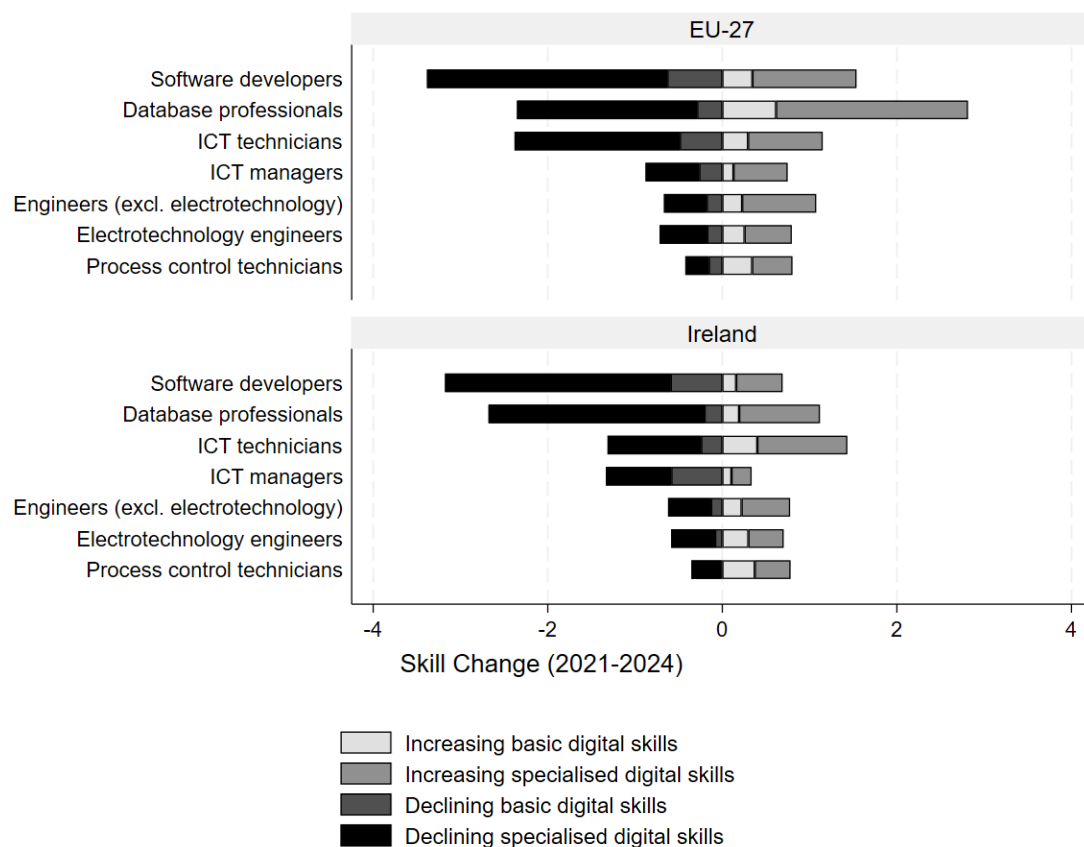
Source: Lightcast, authors' calculations.

Notes: ISCO 3-digit categories are slightly relabelled here for visualisation purposes. EU-27 figures are the population-weighted average across countries.

When comparing positive and negative skill change across digital occupations in Ireland and the EU (see Figure 4.4), the main difference is that software and applications developers and analysts, database and network professionals and ICT technicians exhibited slightly higher rates of skill emergence in the EU than in Ireland. Additionally, ICT technicians exhibited relatively lower levels of skill decline in the EU-27

when compared to those in Ireland. All figures for the other occupational categories are similar.

Figure 4.4 Positive and negative digital skill change values (digital occupations, Ireland and EU-27, 2021–2024)



Source: Lightcast, authors' calculations.

Notes: ISCO 3-digit categories are slightly relabelled here for visualisation purposes. EU-27 figures are the population-weighted average across countries.

4.3 Skill composition analysis

4.3.1 Methodology

In this section, we examine the most important digital skill requirements, both basic and specialised, in digital occupations. First, for each digital occupational category, we extract the top ten most demanded skills in 2024 and count how many times a specific skill appears among the top ten skills across all occupations. Second, we examine the most significant *emerging* skills: specifically, we define emerging skills as the most-demanded skills (by the percentage of vacancies they appear in 2024), for which demand has increased by five percentage points or more between 2021 and 2024 within each

occupation. We also check for the degree of overlap between emerging skills across all digital occupations (i.e. we count whether a specific emerging skill appears among all emerging skills across occupations). We then analyse *declining* skills: they are defined as the most demanded skills (by the percentage of vacancies they appear in 2024), for which demand has decreased by five percentage points or more between 2021 and 2024. We also check for the degree of overlap between declining skills across all digital occupations (i.e. we count whether a specific declining skill appears among all declining skills across occupations). Finally, we identify skills that are highly important to each occupational category, in that demand for them is high and for which demand has remained constant over time (i.e. ‘stable skills’). Specifically, *stable* skills are defined as highly required across digital vacancies in 2024 and for which appearance across vacancies changed by less than or equal to five percentage points since 2021. We also check for the degree of overlap between stable skills across all digital occupations (i.e. we count whether a specific stable skill appears among all stable skills across occupations). We now summarise the main results across all digital occupations as well as for each digital occupation in turn.

When interpreting these results, it is important to note that the ESCO skills taxonomy coded within Lightcast contains varying levels of granularity, mixing broad competency categories (e.g. computer programming) with highly specific software tools and languages (e.g. CSS or AutoCAD). Consequently, counting the absolute number of skills declining or emerging does not perfectly equate to the volume or complexity of expertise required. The decline of a highly specific skill term may reflect the obsolescence of a single software package, or its amalgamation into a broader competency requirement, rather than a reduction in the overall technical complexity of the role. We explore this dynamic further through qualitative feedback from workshop participants in Chapter 6.

4.3.2 Results

We show the **most frequently demanded** skills across digital occupations in 2024, both basic and specialised, in Table 4.5, where we also provide the number of digital occupations within which a specific skill has been demanded in job vacancies. For instance, if a competency has the figure seven beside it, this indicates that it was listed as a top ten demanded competency in all seven of our digitally

intensive occupations in 2024.^{12,13} For basic skills in 2024, the ability to use Office software including Excel, a knowledge of hardware components and computer literacy were consistently listed across a high proportion of vacancies in all seven occupations. The most frequently demanded specialist skills across all digital occupations in 2024 were programming, knowledge of business ICT systems, database management and knowledge of data processing.

Table 4.5 Most frequently demanded skills, 2024

Most demanded skills (2024)			
Basic skills		Specialised skills	
Skill name	Occupation count	Skill name	Occupation count
Excel	7	Computer programming	7
Hardware components	7	Business ICT systems	6
Have computer literacy	7	Database	5
Office software	7	Process data	5
Use Microsoft Office	7	Administer ICT system	4
Use Office systems	6	Use object-oriented programming	4
Use spreadsheet software	5	Use software design patterns	4
Use Word processing software	5		
Use Creative Suite software	4		
Use ICT hardware	4		

Source: Lightcast data (authors' elaboration).

Note: To identify the most demanded skills across digital occupations, we extract the top ten most demanded skills for each digital occupation and count how many times a specific skill appears among the top ten skill across all occupations.

In Table 4.6, we list the skills that have remained **stable** across most digital occupations over the period 2021 to 2024; not surprisingly these are highly correlated with the most commonly demanded skills in 2024 only, as listed in Table 4.5. There was a higher rate of stability in the

¹² Note that the 'occupational count' exercise is an ex-post statistic, and it does not form part of the selection criteria for a skill to be included.

¹³ For a more granular breakdown of the demand distribution, the exact percentage of job advertisements each skill appeared in, disaggregated by individual occupation and year, is provided in Tables A1–A7 in the appendix.

basic skills that were demanded between 2021 and 2024 relative to specialist skills. A wide range of basic competencies, largely related to the use of Microsoft Office software, remained stable over the period. The demand for specialist programming, data processing skills and a knowledge of business ICT systems remained stable across most occupations over time.

Table 4.6 Skills with stable demand between 2021 and 2024

Stable skills			
Basic skills		Specialised skills	
Skill name	Occupation count	Skill name	Occupation count
Hardware components	7	Business ICT systems	6
Excel	6	Computer programming	6
Have computer literacy	5	Process data	6
Office software	5	Cloud technologies	4
Use ICT hardware	5	ICT system programming	4
Use Microsoft Office	5		
Use spreadsheets software	5		
Use Word processing software	5		
Use Office systems	4		

Source: Lightcast data, Authors' elaboration.

Note: Stable skills are defined as highly required across digital vacancies in 2024 and for which appearance across vacancies changed by less than or equal to five percentage points since 2021.

We show cross-cutting **emerging** skills in Table 4.7. It is noticeable that only a small number of competencies saw consistent increases of five percentage points or more in their relative vacancy shares over the 2021 to 2024 period. Focusing on specialist skills, the demand for ICT infrastructure skills became more dominant in four of the seven digital occupations, while the use of CAE software, database and Visual Studio .NET skills increased in importance in up to three digital occupations.

Table 4.7 Skills with emerging demand between 2021 and 2024

Emerging skills			
Basic		Specialised	
Skills	Occupation count	Skills	Occupation count
Use creative suite software	3	ICT infrastructure	4
Use Office systems	2	Use CAE software	3
		Database	2
		Visual Studio .NET	2

Source: Lightcast data, authors' elaboration.

Note: Emerging skills are defined as those for which the largest positive difference was recorded in the share of vacancies requiring the skill between 2021 and 2024, limited to skills that changed by five percentage points or more.

Finally, in Table 4.8 we examine the skills that have **declined** in dominance across digitally intensive occupations over the 2021 to 2024 period (according to the rule of more than the five percentage point threshold). With respect to basic skills, the demand for knowledge of communication and collaboration software fell in five of the seven occupations, while the demand for skills relating to managing data and digital content fell in four occupations. However, the number of declining specialist skills greatly outweighed the number of declining basic skills. The demand for skills related to software configuration management and web programming declined in three of the seven occupations, while the demand for CSS and SAP skills declined in three occupations. Additionally, a range of other specific legacy tools and advanced digital skills experienced falling demand across a minority of the selected occupations. As discussed further in Chapter 6, this apparent contraction often may reflect the natural life cycle of specific software packages and/or the consolidation of these granular tasks into broader, more complex skill

architectures, rather than a genuine reduction in the technical expertise required by employers.¹⁴

Table 4.8 Skills with declining demand between 2021 and 2024

Declining skills			
Basic		Specialised	
Skills	Occupation count	Skills	Occupation count
Use communication and collaboration software	5	Tools for software configuration management	4
Manage data, information and digital content	4	Web programming	4
Wordpress	3	CSS	3
Office software	2	SAP	3
		AngularJS	2
		Deploy ICT systems	2
		ICT communications protocols	2
		Linux	2
		Manage ICT data architecture	2
		SQL	2
		Ubuntu	2
		Use object-oriented programming	2

Source: Lightcast data, authors' elaboration.

Note: Declining skills are defined as skills for which the largest negative difference was recorded between the appearance in the share of vacancies in 2021 and in the share of vacancies in 2024, limited to skills that changed by five percentage points or more.

4.3.2.1 Occupation-specific skill composition analysis

The aggregate statistical analysis suggests that for most occupations, there is apparent continuity in the core skill categories requested. However, as will be discussed in Chapter 6, this statistical stability may conceal increasing complexity within the roles. Where measurable shifts did occur, declining skills were more prevalent than emerging ones. However, the data revealed more variation in skill

¹⁴ Furthermore, the ESCO taxonomy contains instances of highly overlapping skill definitions (e.g. distinguishing between 'AutoCAD' and 'create AutoCAD drawings', or 'computer programming' and 'computer science'). Consequently, some of the observed marginal increases or decreases in specific skills may reflect shifts in employer phrasing or the nuances of algorithmic text parsing, rather than a material change in the underlying competency being requested.

composition within specific occupations. In the following section we provide a summary of the findings for each digital occupation, while detailed analysis is presented in Tables A1–A7 in the appendix.

1. ISCO 133: ICT service managers

The skill demand for ICT managers was broadly similar and stable between 2021 and 2024 (see Table A1 for all results). The top ten most demanded skills for ICT managers were near-identical between 2021 and 2024, with the exception of the ordering of ‘agile’ and ‘cloud technologies’. Interestingly, demand for all of the top ten skills fell between 2021 and 2024. That said, the magnitude of these declines was relatively modest, ranging from 1.5 to 6.9 percentage points. As such, the stable skills in this occupational profile are largely the same as those that were most demanded, except for the addition of ‘design graphics’ and ‘computer science’, and the removal of ‘computer programming’ and ‘administer ICT system’. The top three digital skills were ‘business ICT systems’, ‘computer programming’ and ‘analyse software specifications’, these being required in 87.9, 46.8 and 36.3 per cent of all vacancies for ICT managers in 2024, respectively. The specialised digital skills that saw the largest percentage point increases in demand were ‘audit techniques’ (+6.5 percentage points), ‘web analytics’ (+4) and ‘use CAE software’ (+3.2), while ‘SAP’ (-8.8), ‘computer programming’ (-6.9) and ‘administer ICT system’ (-6.7) saw the largest percentage point declines between 2021 and 2024.

2. ISCO 214: Engineering professionals (excluding electrotechnology)

As with ICT managers, the skill demand for engineers was stable and similar across years (see Table A2 in the appendix for all results). The top three skills in both years were ‘business ICT systems’, ‘computer programming’ and ‘database’. The only difference between the top ten skills across years was that ‘analytics’ was replaced by ‘ICT system programming’ in 2024. However, the changes in demand for these two skills was modest, at -0.1 and +1.5 percentage points respectively. Additionally, the stable skills in 2021 and 2024 were near identical to those that were most demanded in 2024, with ‘database’ being replaced by ‘document management’ in this list. The skills that saw the largest percentage point increases were ‘database’ (+5.7 percentage points), ‘use CAE software’ (+4.5) and ‘process data’ (+3.9). The skills that exhibited the largest percentage point decreases were ‘SAP’ (-10.0 percentage points), ‘web programming’ (-8.2) and ‘CSS’ (-3.1).

3. ISCO 215: Electrotechnology engineers

For electrotechnology engineers (see Table A3 for all results), skill demand was broadly similar to that of engineering professionals; the most demanded skills were largely similar across both years, with the exception of the addition of ‘AutoCAD’ and ‘ICT infrastructure’ in 2024. Demand for both these skills grew somewhat over the period. Some other skills, such as ‘ICT infrastructure’, ‘use technical drawing software’ and ‘create AutoCAD drawings’, also saw modest increases in demand between the two time points. Interestingly, demand for some previously important skills declined. For example, demand for ‘SQL’ almost halved, falling from appearing in 9.3 per cent of vacancies in 2021 to just 4.4 per cent in 2024. A similar pattern is present for ‘Java’, ‘C++’ and ‘Agile’. Nevertheless, no skill within this occupation declined by more than the five percentage point threshold over the period, while only two skills (‘ICT infrastructure’ and ‘use technical drawing software’) increased in demand by more than five percentage points.

4. ISCO 251: Software and applications developers and analysts

In general, for software and applications developers and analysts, the top ten most demanded skills did not change substantially between years 2021 and 2024 (see Table A4 in the appendix for all results). The top three most demanded skills in both 2021 and 2024 were ‘business ICT systems’, ‘computer programming’ and ‘analyse software specifications’. Demand for these three skills was stable, and did not change substantially between years. Demand for ‘business ICT systems’ and ‘analyse software specifications’ changed by less than one percentage point between years, while demand for ‘computer programming’ fell from appearing in 73.6 per cent of vacancies for software developers to 68.7 per cent. More notably, the skills ‘Java’, ‘web programming’ and ‘SQL’ fell substantially, dropping by 10.9, 26.8 and 10.9 percentage points respectively between years. The skills that rose the most in demand, in percentage point terms, were ‘ICT infrastructure’ (+12.9 percentage points), ‘use CAE software’ (+5.0) and ‘process data’ (+2.9).¹⁵ However, as with the other occupations, declines in skill demand were more frequent and larger in magnitude than increases in skill demand. The only skill to rise by more than ten percentage points was ‘ICT infrastructure’; all other rising digital skills

¹⁵ See Tables A3 and A4 in the appendix for the full list.

saw increases of five percentage points or less. The skills for which demand fell the most were ‘web programming’ (-26.8 percentage points), ‘CSS’ (-16.6), and ‘Javascript’ (-13.2). Among the ten skills that declined the most, nine of them fell by more than ten percentage points. This suggests that the majority of skill change for software developers in Ireland was driven by skill declines in the demand for existing skills, rather than the emergence of new skills or increase in demand for existing skills.¹⁶

5. ISCO 252: Database and network professionals

For database professionals, the top ten most demanded skills were relatively unchanged across years 2021 to 2024 (see Table A5 for all results). However, the skill ‘web programming’ exhibited a 42.3 percentage point decrease in demand between 2021 and 2024, dropping from appearing in 51.6 per cent of vacancies to just 9.3 per cent. Additionally, the skill ‘ICT infrastructure’ saw a substantial uptick in demand between years, appearing in 36.1 per cent of vacancies in 2024 compared to just 6.7 per cent in 2021. Aside from this, a small number of digital skills exhibited modest increases in demand. However, similar to software developers, demand for many digital skills declined substantially over time, i.e. ‘Ubuntu’, ‘tools for software configuration management’, ‘CSS’, ‘Linux’ and ‘deploy ICT systems’ all saw decreases of over ten percentage points between 2021 and 2024 (Table A5).

6. ISCO 313: Process control technicians

In general, specialised digital skills did not feature as heavily in the data for process control technicians as they did for other digital occupational categories (see Table A6 in the appendix for all results). The most demanded specialised digital skill in 2024 was ‘database’. However, this skill only featured in 23.2 per cent of all vacancies. This is largely indicative of digital skills playing a less important role for process control technicians when compared to other digital occupations. Some changes for specialised digital skills were observed, largely characterised by the emergence of new competencies. For example, ‘Visual Studio .NET’, ‘Objective-C’ and ‘use CAE software’ were all not observed in the data in 2021, but were

¹⁶ This is reflected in the large aggregate skill change value observed for database professionals in the previous section.

demand in 2024 in this occupational category. That said, demand for these skills was modest, appearing in 14.0, 4.2 and 1.9 per cent of vacancies respectively in 2024.

7. ISCO 351: Information and communications technology operations and user support technicians

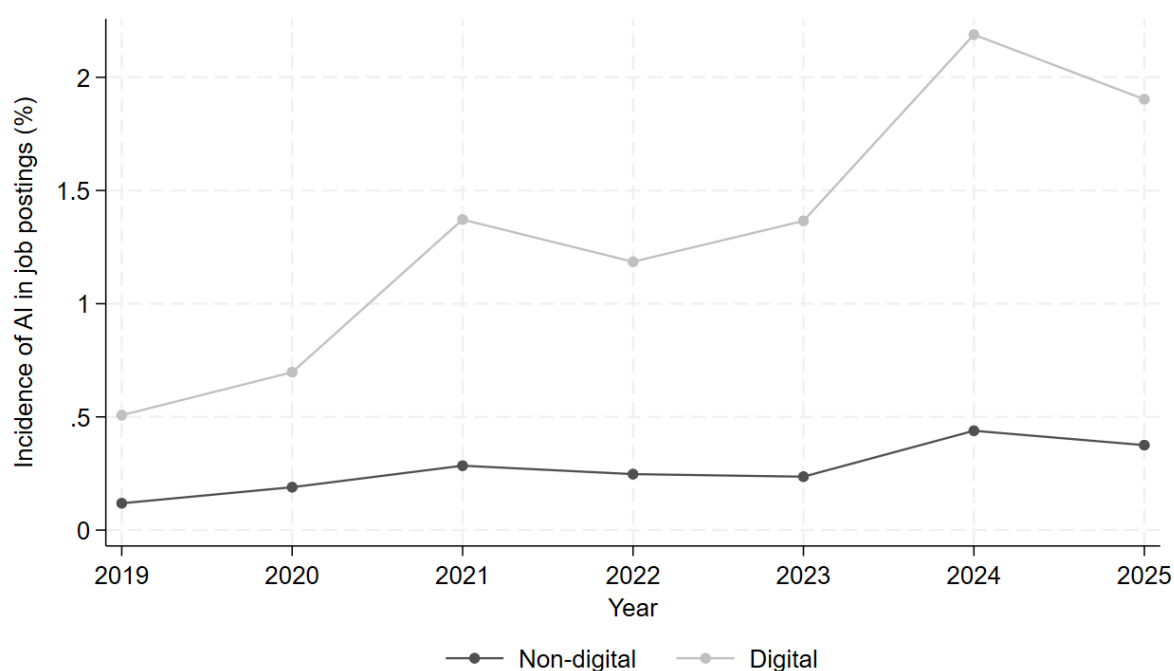
For ICT technicians, several previously important skills became less relevant in 2024 relative to 2021 (see Table A7 for all results). ‘Linux’, ‘manage ICT data architecture’, ‘deploy ICT systems’ and ‘Ubuntu’ all fell by more than 10 percentage points in demand between 2021 and 2024. Other skills, such as ‘ICT infrastructure’ and ‘use software design patterns’, became more important over time. That said, the vast majority of skills in this occupational category saw very little change in demand over time.

Finally, as a robustness check, we also replicate the skill composition analysis for finance professionals (ISCO 241), an occupation that, while not among our core seven digital occupations, nonetheless exhibits a relatively high digital intensity score (see Table 4.1). This analysis was also motivated by feedback from our stakeholder consultation workshop, where participants suggested that cyber security skills (which were not prominent in our main results) may be more prevalent in financial services roles. The results of this robustness exercise are presented in Table A15 and Figures A1 and A2 in the appendix. Overall, skill change appears to be lower among finance professionals than for the core digital occupations; furthermore, contrary to the initial stakeholder hypothesis, cybersecurity skills did not emerge as a dominant or rapidly changing competency within these roles (see Table A15 in the appendix for full details).

4.4 Demand for artificial Intelligence

Given the rapid recent advancements in generative artificial intelligence (AI) and the intense policy focus surrounding its labour market impact, a notable absence from the lists of emerging and highly demanded skills is explicit AI terminology. To investigate this, a specific textual analysis was conducted to track the incidence of the terms ‘AI’ or ‘artificial intelligence’ within Irish job advertisements. Figure 4.5 illustrates the incidence of explicit mentions of ‘AI’ or ‘artificial intelligence’ within the text of Irish job advertisements from

2019 to 2025, disaggregated by digital and non-digital occupations. While the demand for AI within digital occupations has grown since 2019, it peaked in 2024 at just over 2 per cent of total digital vacancies. This confirms that while the technology is highly topical, it is only explicitly requested in a very small minority of job postings. This discrepancy between the public narrative and vacancy data highlights that employers may be prioritising the underlying foundational skills required to interact with advanced technologies, rather than listing AI as a discrete competency; this dynamic is further explored in our stakeholder consultations in Chapter 6. Consistent with this, several of the specific skills the task-based literature associates with AI exposure, such as computer programming, web programming and database/SQL skills (Eloundou et al., 2023; Gmyrek et al., 2023), are among the skills identified in Section 4.4 as declining across digital occupations over this period (Table 4.8). By contrast, skills tied more to deploying and maintaining these tools, such as ICT infrastructure and cloud technologies, were among the more stable or emerging skills (Tables 4.6 and 4.7).

Figure 4.5 Incidence of ‘AI’ and ‘artificial intelligence’ in Irish Job advertisements

Source: Lightcast, authors' calculations.

Note: Based on mentions of the above terms anywhere in the job advertisement.

While the incidence within digital occupations has trended upwards, growing from approximately 0.5 per cent of postings in 2019 to a peak of roughly 2.2 per cent in 2024, it remains a niche explicit requirement. For non-digital occupations, the incidence is even more marginal, remaining below 0.5 per cent even at its 2024 peak. These figures provide context for the broader skill composition analysis, demonstrating that while AI technologies are undoubtedly diffusing through the economy, employers are more rarely articulating a requirement for AI as a standalone skill in their vacancy postings. Instead, it is highly likely that employers continue to recruit for the core foundational competencies (such as programming, database management and cloud technologies) necessary to build and implement these systems, rather than asking for expertise in AI directly.

Overall, the composition analysis in this chapter reveals that the core technical competencies required across digital occupations have remained remarkably stable over the studied period. Where occupational skill profiles have shifted, it is predominantly driven by the obsolescence or declining demand for specific technologies,

rather than a rapid entry of newly emerging skills, suggesting a steady evolution rather than extreme disruption of digital roles.

Chapter 5

Task change and technological change: Evidence from the ESJS

In this section, we employ data from the 2021 European Skills and Jobs Survey (ESJS) as we want to investigate the extent to which employees in digitally intensive occupations in Europe were impacted by new technologies in their jobs, and also the extent to which these new technologies impacted their job task requirements. The ESJS2 is particularly focused on the impact of new digital technologies and technological change on the future of work. We focus particularly on the survey questions related to: (a) the adoption of new digital technologies in the current job during the year preceding the survey, captured by the respondent's need to learn either new computer software or computerised machinery to do the job; and (b) the impact of such technological adoption on task composition, namely if some of a worker's tasks were made redundant or new ones created as a result of new digital technology at the job. As relevant outcomes, several categories of task change arising from new technologies can be identified: workers experiencing new technology at work but no change in tasks performed; workers experiencing new task creation only; workers experiencing task destruction only; finally, workers experiencing both task creation and destruction. The data relate to the EU-27, which reported similar patterns to the Irish data, and will capture the impacts of technology on tasks at the starting point of our study period. While we cannot observe the impact on tasks for the entire 2021 to 2024 period, it will give us a rough sense check on the results from our analysis of the Lightcast data.

5.1 Methodology

We compare the EU-27 outcomes for our seven digitally intensive occupations (which score highly in terms of the job digital intensity index (JDII)), with (1) the remaining jobs scoring in the top 33 per cent of the JDII, (2) employees in the mid-range (33–66 per cent) of the JDII and (3) employees in the lowest range of the JDII. Recall that the

construction of the JDII within the ESJS data has been explained in detail in Section 3.2.¹⁷

To formally test whether occupation group predicts the probability of experiencing each type of task change, we estimate a series of probit models, one for each outcome category j (no task change, destruction only, creation only, both), of the form:

$$\Pr(Y_i = j) = \Phi(\beta_0 + \beta_1 \text{Middle33}_i + \beta_2 \text{Top33}_i + \beta_3 \text{SevenOcc}_i + \beta_4 X_i) \quad (4)$$

where $\Phi(\cdot)$ denotes the standard normal cumulative distribution function, and Y_i indicates individual i 's observed task change outcome. Middle33_i , Top33_i and SevenOcc_i are indicator variables for JDII group membership (lowest 33 per cent is the omitted reference category). X_i is a vector of control variable comprising of gender, level of education, tenure, part-time indicator, country of residence and proxies for work complexity.¹⁸ We report average marginal effects rather than raw coefficients, alongside heteroskedasticity-robust standard errors, for ease of interpretation.

As a robustness test, we also run a single multinomial logit model where the outcome variable is categorised into five groups, with no technological change as the reference group. This allows us to perform formal statistical tests of differences in coefficients between outcome variables.

5.2 Results

In Table 5.1 we compare the extent to which the digitally intensive occupations in 2021 were more prone to task-based technological change compared to the other categories of occupations previously identified. We can see from Table 5.1 that workers in digitally intensive occupations are less likely than other digital categories to have

¹⁷ We use digital index values aggregated at the European level for this exercise, as sample sizes for Ireland are too small. Therefore, we are assuming that Irish and European data follow similar patterns.

¹⁸ 'Uncertain' captures how frequently an employee must react to situations that could not be anticipated (variable=1 if the respondent answers often/always). 'Repetitive' captures how often an employee's job involves short/repetitive tasks (variable=1 if the answer is often/always).

experienced no introduction of new technologies within the workplace. Instead, approximately 57 per cent of employees in digitally intensive occupations experienced the introduction of new technologies in the previous year (as opposed to 43 per cent experiencing no technological change). This is compared to between 27 per cent and 46 per cent for other job categories (i.e. between 73 per cent and 54 per cent that did not experience technological change).

The rates of all forms of task change resulting from new technologies were highest in the seven digitally intensive occupations compared to any of the other job categories. Approximately 19 per cent of employees in the seven digitally intensive occupations experienced new technologies that had no impact on tasks; this compared to rates of between 8 per cent and 14 per cent for other categories of jobs. When new technologies did impact tasks, these incidences were higher in the seven digitally intensive occupations, with the most common outcome being that new technologies simultaneously created new task requirements and eradicated the need for some previously undertaken tasks. This pattern corroborates the skill-level evidence in Section 4.5, where declining skills tend to cluster around tasks artificial intelligence (AI) is thought to substitute directly, while stable or emerging skills cluster around the infrastructure needed to deploy such tools.

Table 5.1 Descriptive on technological change and task change, 2021, EU-27

Sample	No technological change	Task change and creation	Task change and task destruction	Task change and both	Task change and no tasks impact
7 Occupations	42.38%	13.83%	5.77%	19.1%	18.7%
Top 33% JDII	54.57%	10.30%	5.49%	15.3%	14.1%
Middle 33% JDII	60.24%	10.22%	4.03%	11.74%	13.6%
Lowest 33% JDII	73.25%	5.59%	3.46%	9.05%	8.5%

Source: 2021 ESJS, authors' elaboration.

Note: TC = Technological change. JDII = Job digital intensity index.

Table 5.2 presents average marginal effects from probit models estimating the probability of experiencing four outcomes following the introduction of new technologies: no resulting task change, task

destruction only, task creation only, and both task creation and task destruction.

The main variables of interest are the seven digitally intensive occupation categories. Holding job digital intensity and the other observed worker and job characteristics constant, workers in these occupations were significantly more likely to report each outcome. They were 15.4 percentage points more likely to report the introduction of new technology without any resulting task change, 3.9 percentage points more likely to experience task destruction only, 12.3 percentage points more likely to experience task creation only, and 14.5 percentage points more likely to experience both task creation and task destruction. The results therefore indicate that these occupations are more exposed to technological adoption generally, but particularly to task creation and the simultaneous reorganisation of existing tasks.

The models also control for gender, education, tenure, part-time employment and aspects of work organisation. Women, part-time workers and workers with longer tenure were generally less likely to report technology-related task change, while workers with higher education and those in jobs involving more frequent unexpected situations were generally more likely to do so. These variables are included to account for observable differences between workers and jobs, which may be related both to occupational location and to exposure to technological change. The occupation coefficients should therefore be interpreted as conditional associations rather than causal effects.

Table 5.2 Probit model predicting the probability of experiencing various forms of task change arising from new technologies, 2021, EU-27

	(1)	(2)	(3)	(4)
Variables	TC: No task change	TC: Destruction only	TC: Creation only	TC: Both
<i>Ref: lower 33% by JDII</i>				
Middle 33%	0.065*** (0.006)	0.014*** (0.004)	0.069*** (0.005)	0.048*** (0.006)
Top 33%	0.084*** (0.006)	0.031*** (0.004)	0.076*** (0.005)	0.079*** (0.006)
Digital occupations	0.154*** (0.011)	0.039*** (0.008)	0.123*** (0.010)	0.145*** (0.011)
Female	-0.013*** (0.005)	-0.024*** (0.003)	-0.013*** (0.004)	-0.041*** (0.004)
Repetitive	-0.025*** (0.005)	-0.007* (0.004)	-0.005 (0.005)	0.005 (0.005)
Uncertain	0.034*** (0.005)	0.018*** (0.003)	0.037*** (0.004)	0.067*** (0.005)
Tenure	-0.001*** (0.000)	-0.000*** (0.000)	-0.002*** (0.000)	-0.003*** (0.000)
Part-time	-0.017*** (0.006)	-0.003 (0.004)	-0.021*** (0.005)	-0.003 (0.005)
<i>Education (ref: low)</i>				
Middle education	0.030*** (0.007)	0.009** (0.005)	0.032*** (0.007)	-0.006 (0.007)
High education	0.099*** (0.008)	0.039*** (0.005)	0.078*** (0.007)	0.051*** (0.008)
Observations	32,394	28,011	30,490	31,667
Chi ² (Likelihood- Ratio	2015.0***	685.0***	1572.3***	1879.7***
Pseudo-R2	0.0635	0.0464	0.0614	0.0629

Source: 2021 European Skills and Jobs Survey, authors' elaboration.

Note: Coefficients shown are probit marginal effects. Standard errors are heteroskedasticity-robust. Stars after number represent statistical significance. $p < 0.1 = *$, $p < 0.05 = **$, $p < 0.01 = ***$.

These results are echoed by the multinomial logit specification, shown in Table 5.3 overleaf. This additionally allows us to perform Wald tests

to test whether given coefficient differs significantly across categories, rather than relying on visual comparison of separately estimated models. While coefficients on some variables become insignificant in this setup, the overall pattern of results remains. The findings indicate that the association between occupational digital exposure and technological change is not uniform across outcome types. Wald tests shown in Table B5 in the appendix confirm that the occupation group coefficients differ significantly between destruction and every other category, while showing no significant difference in terms of magnitude between the 'no task change' and 'both' categories. This pattern holds at the level of individual occupational tiers as well as jointly: the gap between destruction and creation, for example, is significant for middle 33 per cent, top 33 per cent and digital occupations alike, indicating a broad-based difference rather than one driven by a single occupational segment. In summary, the results suggest that occupational digital exposure is a considerably stronger predictor of task transformation than destruction in isolation, whether through creation of new tasks or a combination of destruction and creation.

Table 5.3 Multinomial logit results predicting the probability of experiencing various forms of task change arising from new technologies, 2021, EU-27

	(1)	(2)	(3)	(4)
Variables	No task change	Destruction only	Creation only	Both
Middle 33%	0.039*** (0.005)	0.003 (0.003)	0.043*** (0.004)	0.024*** (0.004)
Top 33%	0.047*** (0.005)	0.011*** (0.003)	0.042*** (0.004)	0.044*** (0.005)
Digital occupations	0.083*** (0.008)	0.009* (0.005)	0.059*** (0.007)	0.074*** (0.008)
Female	-0.001 (0.003)	-0.013*** (0.002)	-0.003 (0.003)	-0.026*** (0.003)
Repetitive	-0.020*** (0.004)	-0.004* (0.002)	-0.002 (0.004)	0.010*** (0.004)
Uncertain	0.012*** (0.004)	0.006*** (0.002)	0.016*** (0.003)	0.042*** (0.003)
Tenure	-0.000** (0.000)	-0.000 (0.000)	-0.001*** (0.000)	-0.002*** (0.000)
Part-time	-0.010** (0.004)	-0.001 (0.003)	-0.013*** (0.004)	0.004 (0.004)
Middle education	0.022*** (0.006)	0.005 (0.004)	0.024*** (0.005)	-0.013** (0.006)
High education	0.061*** (0.006)	0.017*** (0.004)	0.043*** (0.005)	0.015** (0.006)
Observations	44,694	44,694	44,694	44,694

Notes: Table reports average marginal effects from a multinomial logistic regression, with technological change coded as a five-category outcome (base category: No technological change). Columns (1)–(4) report marginal effects on the probability of each category relative to the base, evaluated from a single jointly-estimated model. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Chapter 6

Discussion and workshop insights

To ground our quantitative findings in the realities of the industry, this chapter presents insights gathered from a consultation workshop with representatives from employers, educational bodies and other relevant stakeholders. This qualitative feedback serves to validate the data trends and unpack the nuanced, real-world dynamics driving the observed changes in employer skill requirements.

As part of the research process, we met with approximately 35 representatives of employers, educationalists and other relevant bodies to reflect, and provide feedback, on the results of the present research. The main findings were presented to the attendees, and they were asked to discuss the following three questions:

- To what extent do the results reflect your own experience of current and changing skill requirements?
- According to you, what are the main factors driving the finding that there are more declining than emerging specialist skills across the digital occupations?
- Has the increased diffusion of artificial intelligence (AI) impacted the nature of demand for (i) basic skills and (ii) specialist skills?

In terms of the results accuracy, it was felt that while there was some stability in many of the requested skills, and declines in others, the meaning of some of the skill terms are likely to have changed substantially. Specifically, it was felt that many of the actual skill requirements associated with particular terms used in the adverts became more complex over the period (2021–2024) and now encompass more competencies than they did before. Some of the participants felt that, in some respects of work, there has been some merging of several required skills under single skill headings. Therefore, it could be problematic to interpret the results as pointing towards static skill requirements within digitally intensive occupations. There was also some surprise expressed that cyber security skills did not feature in the analyses; it was hypothesised that these skills may be more dominant in financial services occupations. Given this, we decided to rerun the analysis on the financial professionals

occupation, as this is also digitally intensive (see Table 3.2); the results are presented in the appendix in Table A15 and Figures A1 and A2.

In terms of explaining the apparent decline in the demand for many digital skills, particularly specialist digital skills, some participants felt that this was explained, at least in part, by the amalgamation of some skill requirements under single categories over time. Furthermore, some of the identified declining skills are very specific software or programming language names, while identified emerging skills tend to be broader categories. This raises the possibility that the apparent change partly reflects a regrouping of specific skills under broader categories rather than an actual decline. For instance, participants highlighted that umbrella terms such as ‘ICT infrastructure’ or ‘containerisation’ are increasingly utilised in job advertisements to capture multiple underlying elements, effectively replacing long lists of specific brand names or legacy tools. Workshop attendees also noted a strategic recruitment shift: employers are increasingly requesting generic competencies rather than highly specific products to capture a broader applicant pool and hire for overall ‘fit’ and adaptability.

It was felt that technological change factors, including AI, had resulted in some of the observed task consolidation processes that were reflected in the observed results. The changing form of job advertisements may not reflect the changing nature of in-house training over time. Job advertisements act principally as a screening mechanism that ensures new entrants to firms possess key essential skills; however, in-house training systems are used to equip new entrants with the specialised skills that are specific to the requirements of the employer. Furthermore, certain front-end skills may be taken for granted in the later data and not explicitly requested, which may explain the apparent decline in the demand for some skills over the 2021 to 2024 period. For example, participants observed that granular front-end web design skills are sometimes subsumed into broader CAE requirements, or are simply assumed as foundational baseline knowledge that does not require explicit listing. Similarly, when discussing AI, industry representatives noted that technical recruiters rarely specify it directly in job advertisements because they are seeking proficiency in the underlying architectural layers. A specific example was provided regarding data science roles: as AI makes routine tasks like data cleaning and preparation quicker and easier, employers are less likely to list those specific routine skills, instead

placing a heavier emphasis on transversal competencies such as critical thinking.

The participants also articulated some concern with the use of vacancy data as the only gauge of industry skill requirements, while recognising that no alternative data sources exists to monitor changing skill requirements in organisations. There was broad agreement among workshop participants on the inadequate nature of data intelligence systems, which are necessary to monitor the changing nature of skill requirements in digitally intensive occupations, and across the labour market more generally, over time. The participants stressed the importance of developing adequate data collection systems to inform skills policy.

Finally, we asked participants about the extent that they felt that AI was impacting the skill requirements in the selected occupations. The consensus was that some impacts were evident through the rising demand for the development of AI-related tools in combination with some task amalgamations as a consequence of process automation. However, it was also felt that while it was possible that AI was having more substantial impacts in less technically specialist occupations, the impacts of AI on jobs and skill requirements were, at least to some extent, subject to exaggeration. Nevertheless, the workshop participants emphasised that as some tasks become automated, as a consequence of AI and other technologies, this was leading to an increase in the importance of communication and transversal skills within digitally complex organisations. Finally, some participants felt that 2025 was somewhat of an inflection point in terms of the diffusion of AI across organisations and jobs, and emphasised the value of repeating the current analysis when new data are available.

CHAPTER 7

Conclusions

This report utilises a large-scale international vacancy dataset to assess the degree to which the technical competencies required by employers in key digitally intensive occupations have evolved between 2021 and 2024. This period is particularly significant as it has been marked by the reported emergence and more rapid adoption of artificial intelligence (AI) in the workplace. The study also benchmarks the extent of labour market change in observed skill demand in Ireland against the EU average. A core objective of the study is to systematically identify digital skills that were highly sought after in 2021 but diminished in importance by 2024 (declining skills), alongside competencies for which the demand has particularly increased over time (emerging skills). Equally important, the study seeks to highlight the foundational digital skills that remained in consistently high demand across both time periods (stable skills).

To achieve these objectives, the study adopts a multi-source empirical approach, combining quantitative job advertisement and survey data with qualitative insights from stakeholder consultations. Initially, data from both the European Labour Force Survey (EU-LFS) and the 2021 European Skills and Jobs Survey (ESJS) are utilised to identify the seven most digitally intensive ISCO 3-digit occupations in Ireland. Subsequent analysis tracks the vacancy dynamics within these critical roles. The findings reveal that the absolute number of overall vacancies in digitally intensive occupations in Ireland remained remarkably stable over the 2021 to 2024 period, at a level of approximately 140,000. However, this aggregate stability masks significant intra-occupational variation. For example, the number of vacancies for engineering professionals increased substantially in the period, from 46,885 to 60,356. Conversely, vacancies for software and applications developers and analysts saw a notable decline, dropping from 57,553 to 41,912 over the same period.

When comparing these domestic trends to the broader European context, distinct divergences emerge. While the absolute number of digital occupation vacancies remained static in Ireland between 2021 and 2024, the EU-27 experienced a 13 per cent increase in this category. Despite this stronger growth rate across Europe, digitally intensive roles continue to represent a significantly larger proportion of

the Irish labour market. In 2024, digital occupations accounted for 18.4 per cent of all vacancies in Ireland, compared to just 11.7 per cent across the EU-27. However, it is important to note that the relative share of digital vacancies out of the total vacancies were higher in 2021 than in 2024 for both regions. In Ireland, this share decreased from 24.2 per cent to 18.4 per cent, and in the EU-27, it fell from 16.4 per cent to 11.7 per cent. This contraction indicates that overall employment opportunities in non-digital occupations have been growing at a faster rate than those in digital sectors during this economic cycle.

When we examine the development of skill profiles, the statistical analysis reveals an apparent continuity in the broad skill categories requested by employers. With respect to specialist digital skills, the top five most requested competencies were highly stable over the period across all seven occupations. ‘Business ICT systems’ and ‘computer programming’ persisted as the most demanded competencies in both 2021 and 2024. While foundational technical needs remained firm, there was an observable decline in the demand for certain established competencies, such as the ability to use software design patterns and administer ICT systems. Looking across the digitally intensive occupations, there was little evidence of rapid growth in any single new specialist competency.

This finding of stability is a dominant theme throughout the aggregate analysis; where shifts in skill composition have occurred, instances of declining skills are far more prevalent than those of emerging skills. This pattern extends to basic digital capabilities, which exhibited a very high rate of stability between 2021 and 2024. Relatively few skills experienced an increase of five percentage points or more in their relative vacancy shares over this period. Concentrating on the specialist skills that did emerge, demand for ‘ICT infrastructure’ skills became more prominent in four of the seven digital occupations. Additionally, requirements for CAE software, database management and Visual Studio .NET skills increased in importance in up to three of the selected occupations.

Conversely, the obsolescence of specific competencies was more pronounced. Demand for skills related to software configuration management and web programming declined across three of the seven occupations. Similarly, the requirement for CSS and SAP skills also

saw a decline across three occupations. A further eight advanced digital skills experienced falling demand in at least two of the seven digitally intensive occupations. Ultimately, the volume of declining specialist skills greatly outweighed the number of declining basic skills, suggesting a faster rate of technological churn at the highly specialised end of the competency spectrum. When the demand for skills within each of the seven occupations is examined individually, these patterns remain consistent: the most requested specialised skills remained highly stable, and where changes in demand levels occurred, decreases were more common than increases. Overall, the observed changes were relatively modest, with no major disruptive shifts in the demand for particular skills recorded at the detailed occupational level.

To contextualise these vacancy trends, the study incorporates employee-level data from the 2021 ESJS. These data indicate that, at an EU level, workers in digitally intensive roles are more acutely exposed to technological change; approximately 57 per cent of employees in these occupations experienced the introduction of new technologies into their jobs, while 42 per cent experienced no technological change. This is substantially higher than the 27 per cent to 46 per cent reported across other, less digitally intensive job categories. Despite this high exposure, approximately 19 per cent of employees in the seven digitally intensive occupations experienced the introduction of new technologies that ultimately had no impact on the tasks they performed, compared to rates of between 8 per cent and 14 per cent for other occupational groupings. However, when new technologies did impact daily operations, the most common outcome within the digital cohort was a dual effect: new technologies simultaneously created new task requirements while eradicating the need for previously undertaken tasks. Econometric modelling supports these descriptive findings, demonstrating that employees in these seven occupations hold a higher probability that new technologies will either solely create new tasks or simultaneously drive both task creation and destruction. Consistent with our descriptives, econometric evidence based on the ESJS showed, at EU level, that employees in the seven digitally intensive occupations had a lower probability of new technologies having no impact on tasks, but also had higher probabilities that new technologies will (1) create new tasks only or (2) both create and destroy tasks.

The quantitative findings of this report were triangulated through a consultation workshop with industry and education representatives. Participants provided critical insight into the data, suggesting that while the empirical evidence points to stability in many requested skills and a decline in others, the underlying meaning of the skill terms used in job postings is likely to have changed substantially over time. Industry experts indicated that the actual competencies associated with particular terms in job advertisements have become more complex, with broader terms now encompassing a wider array of discrete capabilities. Consequently, the apparent decline in demand for many specialist digital skills may be driven, at least partially, by the amalgamation of various skill requirements under single, overarching categories. This hypothesis is supported by the data, which show that identified declining skills are frequently very specific software or programming language names (e.g. CSS, SAP, AngularJS), whereas emerging skills tend to be broader architectural categories (e.g. ICT infrastructure). This raises the distinct possibility that observed changes partially reflect a regrouping of technical requirements rather than an absolute decline in the underlying tasks.

When queried on the impact of AI on current skill requirements, the consensus among stakeholders was that impacts are indeed evident, primarily through rising demand for the development of AI-related tools and the amalgamation of tasks resulting from process automation. However, participants cautioned against overstating these effects, suggesting that while AI may be causing more substantial disruptions in less technically specialised occupations, its short-term transformative impact on highly specialised digital skill requirements is, to some extent, subject to public exaggeration. Furthermore, workshop participants emphasised that as certain technical tasks become automated by AI and other emerging technologies, the premium placed on transversal and communication skills within digitally complex organisations is rising significantly. Finally, industry experts identified the year 2025 as a potential inflection point for the deeper structural diffusion of AI across organisations, highlighting the potential value of repeating similar analysis as new labour market data become available.

Overall, this report provides empirical labour market intelligence necessary to inform strategic workforce planning and curricula development by highlighting key insights in relation to digital skills

demand. The observed stability of foundational competencies indicates that educational pathways yield significant long-term value when prioritising enduring computational architectures over more transient software packages, which are increasingly prone to more rapid obsolescence. Furthermore, as emerging technologies, such as AI, drive task consolidation and role complexity, technical proficiency must be increasingly supported by transversal and communication skills, highlighting the critical need for policy frameworks that support lifelong learning and workforce adaptability. Lastly, because official statistical classifications often lag behind the pace of digital transformation, this report reiterates the necessity of robust, real-time labour market intelligence systems, such as the continuous monitoring of vacancy data, to ensure that national education and training provisions remain responsively aligned with the evolving needs of the digital economy.

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APPENDIX

Table A1 ICT service managers: Most important, emerging, declining and stable skills (Ireland, 2021 and 2024)

Most demanded specialised digital skills (2021)			
Skill name	% vacancies (2021)	% vacancies (2024)	Difference (percentage points)
Business ICT systems	90.0%	87.9%	-2.1%
Computer programming	53.7%	46.8%	-6.9%
Analyse software specifications	39.7%	36.3%	-3.3%
Administer ICT system	37.6%	30.9%	-6.7%
Database	28.4%	27.0%	-1.5%
ICT system programming	21.9%	19.6%	-2.3%
Process data	16.3%	14.5%	-1.7%
Analytics	15.7%	14.1%	-1.6%
Agile	13.8%	11.6%	-2.2%
Cloud technologies	13.4%	11.8%	-1.6%
Most demanded specialised digital skills (2024)			
Business ICT systems	90.0%	87.9%	-2.1%
Computer programming	53.7%	46.8%	-6.9%
Analyse software specifications	39.7%	36.3%	-3.3%
Administer ICT system	37.6%	30.9%	-6.7%
Database	28.4%	27.0%	-1.5%
ICT system programming	21.9%	19.6%	-2.3%
Process data	16.3%	14.5%	-1.7%
Analytics	15.7%	14.1%	-1.6%
Cloud technologies	13.4%	11.8%	-1.6%
Agile	13.8%	11.6%	-2.2%
Emerging specialised digital skills (2021–2024)			
Audit techniques	0.0%	6.5%	6.5%
Web analytics	2.7%	6.7%	4.0%
Use CAE software	0.0%	3.2%	3.2%
Objective-C	0.0%	1.9%	1.9%
Cyber security	1.7%	3.2%	1.5%
Python (computer programming)	1.5%	2.3%	0.8%
AutoCAD	0.0%	0.7%	0.7%
Design graphics	9.7%	10.2%	0.6%
Internet of Things	0.0%	0.5%	0.5%
Docker	0.0%	0.5%	0.5%

Table A1 (contd.) ICT managers: Most important, emerging, declining and stable skills (Ireland, 2021 and 2024)

Declining specialised digital skills (2021–2024)			
Skill name	% vacancies (2021)	% vacancies (2024)	Difference (percentage points)
SAP	9.5%	0.7%	-8.8%
Computer programming	53.7%	46.8%	-6.9%
Administer ICT system	37.6%	30.9%	-6.7%
CSS	6.4%	0.8%	-5.6%
Change management	5.4%	1.8%	-3.7%
Analyse software specifications	39.7%	36.3%	-3.3%
ICT project management methodologies	6.7%	3.7%	-3.0%
Role manager	4.9%	2.1%	-2.7%
ICT system programming	21.9%	19.6%	-2.3%
Agile	13.8%	11.6%	-2.2%
Number of vacancies	4,194	5,325	
Stable specialised digital skills (2021)			
Skill name	% vacancies (2021)	% vacancies (2024)	Difference (percentage points)
Business ICT systems	90.0%	87.9%	-2.1%
Analyse software specifications	39.7%	36.3%	-3.3%
Database	28.4%	27.0%	-1.5%
ICT system programming	21.9%	19.6%	-2.3%
Process data	16.3%	14.5%	-1.7%
Analytics	15.7%	14.1%	-1.6%
Cloud technologies	13.4%	11.8%	-1.6%
Agile	13.8%	11.6%	-2.2%
Design graphics	9.7%	10.2%	0.6%
Computer science	11.6%	9.9%	-1.7%
Number of vacancies	4,194	5,325	

Source: Lightcast, authors' calculations.

Table A2 Engineering professionals (excluding electrotechnology: Most important, emerging, declining and stable skills (Ireland, 2021 and 2024)

Most demanded specialised digital skills (2021)			
Skill name	% vacancies (2021)	% vacancies (2024)	Difference (percentage points)
Business ICT systems	54.8%	53.9%	-0.9%
Computer programming	42.5%	44.1%	1.6%
Database	28.4%	34.1%	5.7%
Analyse software specifications	23.3%	24.4%	1.0%
Use software design patterns	20.9%	23.0%	2.1%
Process data	20.6%	24.6%	3.9%
Use object-oriented programming	17.3%	17.4%	0.1%
Use technical drawing software	17.0%	19.3%	2.3%
Analytics	13.9%	13.8%	-0.1%
Automation technology	13.7%	13.9%	0.2%
Most demanded specialised digital skills (2024)			
Business ICT systems	54.8%	53.9%	-0.9%
Computer programming	42.5%	44.1%	1.6%
Database	28.4%	34.1%	5.7%
Process data	20.6%	24.6%	3.9%
Analyse software specifications	23.3%	24.4%	1.0%
Use software design patterns	20.9%	23.0%	2.1%
Use technical drawing software	17.0%	19.3%	2.3%
Use object-oriented programming	17.3%	17.4%	0.1%
ICT system programming	13.6%	15.1%	1.5%
Automation technology	13.7%	13.9%	0.2%
Emerging specialised digital skills (2021–2024)			
Database	28.4%	34.1%	5.7%
Use CAE software	0.0%	4.5%	4.5%
Process data	20.6%	24.6%	3.9%
Design graphics	7.6%	10.7%	3.1%
Autocad	4.3%	7.3%	3.0%
Create AutoCAD drawings	3.9%	6.7%	2.8%
Use technical drawing software	17.0%	19.3%	2.3%
Use software design patterns	20.9%	23.0%	2.1%
Document management	12.1%	13.9%	1.8%
CAD software	0.2%	1.9%	1.7%

Table A2 (contd.) Engineering professionals (excluding electrotechnology): Most important, emerging, declining and stable skills (Ireland, 2021 and 2024)

Declining specialised digital skills (2021–2024)			
Skill name	% vacancies (2021)	% vacancies (2024)	Difference (percentage points)
Web programming	12.8%	4.6%	-8.2%
CSS	3.8%	0.7%	-3.1%
Deploy ICT systems	3.9%	2.0%	-2.0%
Operate relational database management system	8.5%	6.6%	-1.9%
Manage ICT data architecture	4.1%	2.2%	-1.9%
Linux	4.1%	2.2%	-1.9%
ICT communications protocols	1.9%	0.3%	-1.6%
AngularJS	1.4%	0.0%	-1.4%
SQL	6.2%	5.1%	-1.1%
Number of vacancies	46,885	60,356	
Stable specialised digital skills (2021)			
Business ICT systems	54.8%	53.9%	-0.9%
Computer programming	42.5%	44.1%	1.6%
Process data	20.6%	24.6%	3.9%
Analyse software specifications	23.3%	24.4%	1.0%
Use software design patterns	20.9%	23.0%	2.1%
Use technical drawing software	17.0%	19.3%	2.3%
Use object-oriented programming	17.3%	17.4%	0.1%
ICT system programming	13.6%	15.1%	1.5%
Automation technology	13.7%	13.9%	0.2%
Document management	12.1%	13.9%	1.8%
Number of vacancies	46,885	60,356	

Source: Lightcast, authors' calculations.

Table A3 Electrotechnology engineers: Most important, emerging, declining and stable skills (Ireland, 2021 and 2024)

Most demanded specialised digital skills (2021)			
Skill name	% vacancies (2021)	% vacancies (2024)	Difference (percentage points)
Business ICT systems	67.3%	64.9%	-2.4%
Computer programming	47.0%	48.3%	1.4%
Use object-oriented programming	21.9%	17.6%	-4.2%
Use technical drawing software	21.8%	27.0%	5.2%
Automation technology	18.7%	20.1%	1.4%
CAE software	16.2%	17.5%	1.2%
Computer technology	15.1%	12.2%	-2.9%
Use scripting programming	13.6%	10.1%	-3.5%
Analytics	9.3%	8.6%	-0.7%
SQL	7.9%	4.4%	-3.6%
Most demanded specialised digital skills (2024)			
Business ICT systems	67.3%	64.9%	-2.4%
Computer programming	47.0%	48.3%	1.4%
Use technical drawing software	21.8%	27.0%	5.2%
Automation technology	18.7%	20.1%	1.4%
Use object-oriented programming	21.9%	17.6%	-4.2%
CAE software	16.2%	17.5%	1.2%
Computer technology	15.1%	12.2%	-2.9%
AutoCAD	6.8%	11.0%	4.2%
ICT infrastructure	2.4%	10.4%	8.0%
Use scripting programming	13.6%	10.1%	-3.5%
Emerging specialised digital skills (2021–2024)			
ICT infrastructure	2.4%	10.4%	8.0%
Use technical drawing software	21.8%	27.0%	5.2%
Create autocad drawings	5.3%	9.8%	4.5%
AutoCAD	6.8%	11.0%	4.2%
Use CAE software	0.0%	3.6%	3.6%
CAD software	0.0%	2.2%	2.2%
Use shorthand computer program	0.0%	2.1%	2.1%
Process data	2.6%	4.4%	1.7%
CAM software	0.0%	1.5%	1.5%
Automation technology	18.7%	20.1%	1.4%

Table A3 (contd.) Electrotechnology engineers: Most important, emerging, declining and stable skills (Ireland, 2021 and 2024)

Declining specialised digital skills (2021–2024)			
Skill name	% vacancies (2021)	% vacancies (2024)	Difference (percentage points)
Use object-oriented programming	21.9%	17.6%	-4.2%
C++	4.3%	0.7%	-3.7%
SQL	7.9%	4.4%	-3.6%
Use scripting programming	13.6%	10.1%	-3.5%
Programme a CNC controller	5.3%	1.8%	-3.5%
Agile	7.1%	3.7%	-3.4%
Java (computer programming)	6.2%	3.0%	-3.1%
Scripting	7.6%	4.6%	-3.0%
Computer technology	15.1%	12.2%	-2.9%
Business ICT systems	67.3%	64.9%	-2.4%
Number of vacancies	7,652	8,114	
Stable specialised digital skills (2021)			
Business ICT systems	67.3%	64.9%	-2.4%
Computer programming	47.0%	48.3%	1.4%
Automation technology	18.7%	20.1%	1.4%
Use object-oriented programming	21.9%	17.6%	-4.2%
CAE software	16.2%	17.5%	1.2%
Computer technology	15.1%	12.2%	-2.9%
AutoCAD	6.8%	11.0%	4.2%
Use scripting programming	13.6%	10.1%	-3.5%
Create autocad drawings	5.3%	9.8%	4.5%
Analytics	9.3%	8.6%	-0.7%
Number of vacancies	7,652	8,114	

Source: Lightcast, authors' calculations.

Table A4 Software and applications developers and analysts: Most important, emerging, declining and stable skills (Ireland, 2021 and 2024)

Most demanded specialised digital skills (2021)			
Skill name	% vacancies (2021)	% vacancies (2024)	Difference (percentage points)
Business ICT systems	83.4%	84.2%	0.8%
Computer programming	73.6%	68.7%	-4.9%
Analyse software specifications	49.4%	49.6%	0.2%
Use object-oriented programming	47.6%	39.9%	-7.7%
Java (computer programming)	45.1%	34.2%	-10.9%
Database	43.3%	45.8%	2.5%
Use software design patterns	41.5%	42.3%	0.7%
Administer ICT system	41.3%	34.2%	-7.1%
Web programming	41.2%	14.4%	-26.8%
SQL	39.0%	28.1%	-10.9%
Most demanded specialised digital skills (2024)			
Business ICT systems	83.4%	84.2%	0.8%
Computer programming	73.6%	68.7%	-4.9%
Analyse software specifications	49.4%	49.6%	0.2%
Database	43.3%	45.8%	2.5%
Use software design patterns	41.5%	42.3%	0.7%
Use object-oriented programming	47.6%	39.9%	-7.7%
Java (computer programming)	45.1%	34.2%	-10.9%
Administer ICT system	41.3%	34.2%	-7.1%
SQL	39.0%	28.1%	-10.9%
Process data	24.0%	27.0%	2.9%
Emerging specialised digital skills (2021–2024)			
ICT infrastructure	1.3%	14.2%	12.9%
Use CAE software	0.0%	5.0%	5.0%
Process data	24.0%	27.0%	2.9%
Database	43.3%	45.8%	2.5%
Internet of Things	0.1%	2.4%	2.3%
Microsoft access	7.7%	10.0%	2.3%
Web analytics	1.2%	3.3%	2.1%
Azure	8.7%	10.7%	1.9%
Visual Studio .NET	0.4%	2.3%	1.9%
Objective-C	0.1%	1.5%	1.5%

Table A4 (contd.) Software and applications developers and analysts: Most important, emerging, declining and stable skills (Ireland, 2021 and 2024)

Declining specialised digital skills (2021–2024)			
Skill name	% vacancies (2021)	% vacancies (2024)	Difference (percentage points)
Web programming	41.2%	14.4%	-26.8%
CSS	21.7%	5.1%	-16.6%
Javascript	14.6%	1.4%	-13.2%
AngularJS	18.8%	5.7%	-13.2%
Implement front-end website design	27.9%	14.9%	-12.9%
Unified modelling language	31.9%	19.6%	-12.3%
SQL	39.0%	28.1%	-10.9%
Java (computer programming)	45.1%	34.2%	-10.9%
Tools for software configuration management	18.3%	7.6%	-10.6%
Use object-oriented programming	47.6%	39.9%	-7.7%
Number of vacancies	57,553	41,912	
Stable specialised digital skills (2021)			
Business ICT systems	83.4%	84.2%	0.8%
Computer programming	73.6%	68.7%	-4.9%
Analyse software specifications	49.4%	49.6%	0.2%
Database	43.3%	45.8%	2.5%
Use software design patterns	41.5%	42.3%	0.7%
Process data	24.0%	27.0%	2.9%
Cloud technologies	24.2%	25.1%	0.9%
Integrated development environment software	25.1%	25.1%	-0.1%
Computer science	23.3%	24.2%	0.8%
ICT system programming	21.6%	22.0%	0.3%
Number of vacancies	57,553	41,912	

Source: Lightcast, authors' calculations.

Table A5 Database and network professionals: Most important, emerging, declining and stable skills (Ireland, 2021 and 2024)

Most demanded specialised digital skills (2021)			
Skill name	% vacancies (2021)	% vacancies (2024)	Difference (percentage points)
Business ICT systems	80.9%	83.1%	2.3%
Computer programming	56.0%	57.4%	1.5%
Web programming	51.6%	9.3%	-42.3%
Administer ICT system	50.2%	45.3%	-5.0%
Cloud technologies	43.7%	47.7%	4.0%
Database	43.3%	43.0%	-0.3%
SAP R/3	41.0%	36.3%	-4.8%
Use scripting programming	36.3%	31.3%	-4.9%
Process data	27.6%	28.0%	0.4%
Use object-oriented programming	27.1%	27.5%	0.5%
Most demanded specialised digital skills (2024)			
Business ICT systems	80.9%	83.1%	2.3%
Computer programming	56.0%	57.4%	1.5%
Cloud technologies	43.7%	47.7%	4.0%
Administer ICT system	50.2%	45.3%	-5.0%
Database	43.3%	43.0%	-0.3%
SAP R/3	41.0%	36.3%	-4.8%
ICT infrastructure	6.7%	36.1%	29.5%
Use scripting programming	36.3%	31.3%	-4.9%
Use software design patterns	24.3%	29.0%	4.7%
Process data	27.6%	28.0%	0.4%
Emerging specialised digital skills (2021–2024)			
ICT infrastructure	6.7%	36.1%	29.5%
Use CAE software	0.0%	5.2%	5.2%
Use software design patterns	24.3%	29.0%	4.7%
Cloud technologies	43.7%	47.7%	4.0%
Azure	19.8%	23.1%	3.4%
Analytics	17.8%	20.8%	3.0%
Microsoft Access	15.5%	18.4%	2.9%
Internet of Things	0.0%	2.9%	2.9%
Web analytics	1.1%	3.9%	2.8%
Computer science	19.9%	22.2%	2.3%

Table A5 (contd.) Database and network professionals: Most important, emerging, declining and stable skills (Ireland, 2021 and 2024)

Declining specialised digital skills (2021–2024)			
Skill name	% vacancies (2021)	% vacancies (2024)	Difference (percentage points)
Web programming	51.6%	9.3%	-42.3%
Ubuntu	13.2%	0.4%	-12.8%
Tools for software configuration management	16.1%	3.4%	-12.7%
CSS	10.8%	0.3%	-10.5%
Linux	22.2%	11.8%	-10.4%
Deploy ICT systems	21.3%	11.1%	-10.2%
Manage ICT data architecture	21.6%	12.5%	-9.2%
ICT communications protocols	9.7%	1.5%	-8.2%
AngularJS	8.0%	0.0%	-8.0%
SQL	24.6%	19.3%	-5.3%
Number of vacancies	10,344	9,532	
Stable specialised digital skills (2021)			
Business ICT systems	80.9%	83.1%	2.3%
Computer programming	56.0%	57.4%	1.5%
Cloud technologies	43.7%	47.7%	4.0%
Administer ICT system	50.2%	45.3%	-5.0%
Database	43.3%	43.0%	-0.3%
SAP R/3	41.0%	36.3%	-4.8%
Use scripting programming	36.3%	31.3%	-4.9%
Use software design patterns	24.3%	29.0%	4.7%
Process data	27.6%	28.0%	0.4%
Use object-oriented programming	27.1%	27.5%	0.5%
Number of vacancies	10,344	9,532	

Source: Lightcast, authors' calculations.

Table A6 Process control technicians: Most important, emerging, declining and stable skills (Ireland, 2021 and 2024)

Most demanded specialised digital skills (2021)			
Skill name	% vacancies (2021)	% vacancies (2024)	Difference (percentage points)
Database	14.0%	23.2%	9.2%
Tools for software configuration management	12.7%	0.0%	-12.7%
Analytics	6.7%	2.9%	-3.8%
Document management	6.1%	6.8%	0.6%
SAP	5.4%	0.5%	-4.9%
Process data	4.6%	4.0%	-0.6%
Role manager	4.1%	2.7%	-1.4%
Analyse business requirements	3.7%	2.2%	-1.5%
Operate relational database management system	3.3%	2.0%	-1.3%
Integrated development environment software	2.6%	2.1%	-0.5%
Most demanded specialised digital skills (2024)			
Database	14.0%	23.2%	9.2%
Visual Studio .NET	0.0%	14.0%	14.0%
Document management	6.1%	6.8%	0.6%
Objective-C	0.0%	4.2%	4.2%
Process data	4.6%	4.0%	-0.6%
Computer programming	1.2%	3.1%	1.8%
Analytics	6.7%	2.9%	-3.8%
Role manager	4.1%	2.7%	-1.4%
Tend computer numerical control lathe machine	1.1%	2.4%	1.3%
Analyse business requirements	3.7%	2.2%	-1.5%
Emerging specialised digital skills (2021–2024)			
Visual Studio .NET	0.0%	14.0%	14.0%
Database	14.0%	23.2%	9.2%
Objective-C	0.0%	4.2%	4.2%
Use CAE software	0.0%	1.9%	1.9%
Computer programming	1.2%	3.1%	1.8%
Repair ICT devices	0.0%	1.4%	1.4%
Tend computer numerical control lathe machine	1.1%	2.4%	1.3%
Virtualisation	0.9%	1.9%	1.1%
Implement a virtual private network	0.9%	1.9%	1.1%
ICT system programming	0.7%	1.6%	0.9%

Table A6 (contd.) Process control technicians: Most important, emerging, declining and stable skills (Ireland, 2021 and 2024)

Declining specialised digital skills (2021–2024)			
Skill name	% vacancies (2021)	% vacancies (2024)	Difference (percentage points)
Tools for software configuration management	12.7%	0.0%	-12.7%
SAP	5.4%	0.5%	-4.9%
Analytics	6.7%	2.9%	-3.8%
LIMS	1.7%	0.0%	-1.7%
Analyse business requirements	3.7%	2.2%	-1.5%
Role manager	4.1%	2.7%	-1.4%
Operate relational database management system	3.3%	2.0%	-1.3%
Benchmarking	1.7%	0.5%	-1.2%
Robotics	0.9%	0.0%	-0.9%
AngularJS	0.9%	0.0%	-0.9%
Number of vacancies	4,018	5,763	
Stable specialised digital skills (2021)			
Document management	6.1%	6.8%	0.6%
Objective-C	0.0%	4.2%	4.2%
Process data	4.6%	4.0%	-0.6%
Computer programming	1.2%	3.1%	1.8%
Analytics	6.7%	2.9%	-3.8%
Role manager	4.1%	2.7%	-1.4%
Tend computer numerical control lathe machine	1.1%	2.4%	1.3%
Analyse business requirements	3.7%	2.2%	-1.5%
Integrated development environment software	2.6%	2.1%	-0.5%
Operate relational database management system	3.3%	2.0%	-1.3%
Number of vacancies	4,018	5,763	

Source: Lightcast, authors' calculations.

Table A7 Information and communications technology operations and user support technicians: Most important, emerging, declining and stable skills (Ireland, 2021 and 2024)

Most demanded specialised digital skills (2021)			
Skill name	% vacancies (2021)	% vacancies (2024)	Difference (p.p.)
Business ICT systems	82.2%	86.9%	4.7%
Administer ICT system	51.4%	48.5%	-2.9%
Computer programming	37.6%	39.3%	1.7%
Use object-oriented programming	24.1%	19.0%	-5.1%
Use software design patterns	19.1%	24.7%	5.5%
Computer technology	16.0%	19.9%	3.9%
Linux	15.4%	5.2%	-10.2%
Manage ICT data architecture	15.3%	4.8%	-10.5%
Deploy ICT systems	14.9%	4.6%	-10.3%
Document management	14.7%	17.6%	2.9%
Most demanded specialised digital skills (2024)			
Business ICT systems	82.2%	86.9%	4.7%
Administer ICT system	51.4%	48.5%	-2.9%
Computer programming	37.6%	39.3%	1.7%
Use software design patterns	19.1%	24.7%	5.5%
Computer technology	16.0%	19.9%	3.9%
ICT infrastructure	7.1%	19.2%	12.2%
Use object-oriented programming	24.1%	19.0%	-5.1%
Document management	14.7%	17.6%	2.9%
Use scripting programming	13.9%	16.7%	2.8%
ICT system programming	14.2%	16.7%	2.5%
Emerging specialised digital skills (2021–2024)			
ICT infrastructure	7.1%	19.2%	12.2%
Visual Studio .NET	0.0%	6.9%	6.9%
Use CAE software	0.0%	6.6%	6.6%
Use software design patterns	19.1%	24.7%	5.5%
Business ICT systems	82.2%	86.9%	4.7%
Analyse software specifications	8.6%	12.9%	4.2%
Internet of Things	0.0%	4.2%	4.2%
Computer technology	16.0%	19.9%	3.9%
Use technical drawing software	5.5%	9.3%	3.8%
Process data	11.9%	15.5%	3.6%

Table A7 (contd.) Information and communications technology operations and user support technicians: Most important, emerging, declining and stable skills (Ireland, 2021 and 2024)

Declining specialised digital skills (2021–2024)			
Skill name	% vacancies 2021	% vacancies 2024	Difference (percentage points)
Ubuntu	13.2%	0.0%	-13.2%
Manage ICT data architecture	15.3%	4.8%	-10.5%
Deploy ICT systems	14.9%	4.6%	-10.3%
Linux	15.4%	5.2%	-10.2%
SAP	7.1%	0.4%	-6.7%
ICT communications protocols	8.1%	1.7%	-6.4%
Web programming	6.8%	0.9%	-5.9%
Tools for software configuration management	5.5%	0.3%	-5.2%
Use object-oriented programming	24.1%	19.0%	-5.1%
Java (computer programming)	10.7%	6.3%	-4.4%
Number of vacancies	10,062	8,765	
Stable specialised digital skills (2021)			
Business ICT systems	82.2%	86.9%	4.7%
Administer ICT system	51.4%	48.5%	-2.9%
Computer programming	37.6%	39.3%	1.7%
Computer technology	16.0%	19.9%	3.9%
Document management	14.7%	17.6%	2.9%
Use scripting programming	13.9%	16.7%	2.8%
ICT system programming	14.2%	16.7%	2.5%
Microsoft access	12.7%	16.1%	3.4%
Process data	11.9%	15.5%	3.6%
Cloud technologies	11.6%	13.9%	2.3%
Number of vacancies	10,062	8,765	

Source: Lightcast, authors' calculations.

Table A8 The most common job titles in information and communications technology service managers

Job title	% vacancies (2021)	% vacancies (2024)
IT project managers	6.3%	5.5%
Chief technology officers	1.2%	2.3%
Technical project managers	4.6%	2.3%
IT managers	4.4%	2.3%
Directors of information technology	1.0%	1.7%
Digital transformation managers	0.8%	1.7%
Technical managers	2.1%	1.7%
Chief information officers	0.5%	1.4%
Cosmeticians	0.0%	1.2%
District project managers	0.5%	1.1%

Table A9 The most common job titles in engineering professionals (excluding electrotechnology)

Job title	% vacancies (2021)	% vacancies (2024)
Site engineers	6.4%	6.6%
Project engineers	4.0%	4.2%
Process engineers	3.6%	3.6%
Mechanical engineers	3.4%	3.6%
Quality engineers	4.2%	3.4%
Manufacturing engineers	4.1%	3.3%
Civil engineers	2.7%	2.6%
Validation engineers	2.3%	2.1%
Mechanical design engineers	2.0%	1.9%
Structural engineers	1.8%	1.8%

Table A10 The most common job titles in electrotechnology engineers

Job title	% vacancies (2021)	% vacancies (2024)
Electrical engineers	20.1%	18.9%
Electrical design engineers	6.9%	6.0%
Electronics engineers	2.6%	3.8%
Electrical project engineers	3.7%	3.4%
Project engineers	2.1%	3.2%
Graduate electrical engineers	2.2%	2.7%
Engineers	1.2%	1.9%
Plant utilities engineers	2.4%	1.8%
Service engineers	1.8%	1.6%
Analogue design engineers	0.9%	1.1%

Table A11 The most common job titles in software and applications developers and analysts

Job title	% vacancies (2021)	% vacancies (2024)
Software engineers	5.1%	6.5%
Devops engineers	2.4%	2.3%
Data engineers	1.5%	2.0%
Solutions architects	1.6%	1.6%
Full stack developers	1.8%	1.5%
Java developers	2.7%	1.5%
Data scientists	1.3%	1.4%
Software development engineers	0.8%	1.4%
Principal software engineers	0.9%	1.4%
Site reliability engineers	1.1%	1.3%

Table A12 The most common job titles in database and network professionals

Job title	% vacancies (2021)	% vacancies (2024)
Automation engineers	6.1%	8.4%
Network engineers	4.5%	3.9%
Systems administrators	3.6%	2.4%
Security engineers	2.5%	2.3%
Quality systems specialists	1.1%	1.4%
It systems administrators	1.0%	1.4%
Data architects	1.4%	1.1%
Network security engineers	1.4%	1.0%
Database administrators	0.9%	0.9%
Cybersecurity engineers	1.5%	0.9%

Table A13 The most common job titles in process control technicians

Job title	% vacancies (2021)	% vacancies (2024)
Production planners	14.4%	10.8%
Quality assurance validation specialists	8.9%	8.5%
Validation specialists	5.5%	6.9%
Process operators	3.6%	3.3%
CSV consultants	3.5%	1.0%
Process technicians	3.3%	4.6%
Commissioning, qualification and validation engineers	2.0%	0.5%
Plant operators	1.8%	2.9%
Chemical process operators	1.6%	1.1%
Validation leads	1.5%	1.1%

Table A14 The most common job titles in information and communications technology operations and user support technicians

Job title	% vacancies (2021)	% vacancies (2024)
IT support engineers	6.1%	9.8%
Technical support engineers	6.3%	6.1%
IT support technicians	2.0%	2.8%
Desktop support engineers	2.5%	2.8%
Application support engineers	2.1%	2.1%
IT support specialists	1.1%	2.1%
Technical support specialists	2.6%	1.8%
Support engineers	2.3%	1.6%
IT engineers	1.7%	1.5%
Network support engineers	0.2%	1.4%

Table A15 Finance professionals: Most important, emerging, declining and stable skills (Ireland, 2021 and 2024)

Most demanded specialised digital skills (2021)			
Skill name	% vacancies (2021)	% vacancies (2024)	Difference (percentage points)
Process data	29.5%	31.2%	1.6%
Database	25.5%	30.7%	5.2%
Analytics	25.1%	24.3%	-0.9%
SAP R/3	22.1%	26.8%	4.6%
Analyse business requirements	14.3%	18.6%	4.3%
Computer programming	13.1%	9.5%	-3.6%
Operate relational database management system	9.8%	10.5%	0.8%
AngularJS	9.3%	0.0%	-9.3%
Microsoft Access	5.8%	7.5%	1.8%
Oracle	2.9%	2.5%	-0.4%
Most demanded specialised digital skills (2024)			
Process data	29.5%	31.2%	1.6%
Database	25.5%	30.7%	5.2%
SAP R/3	22.1%	26.8%	4.6%
Analytics	25.1%	24.3%	-0.9%
Analyse business requirements	14.3%	18.6%	4.3%
Operate relational database management system	9.8%	10.5%	0.8%
Computer programming	13.1%	9.5%	-3.6%
Microsoft Access	5.8%	7.5%	1.8%
Use CAE software	0.0%	5.8%	5.8%
Audit techniques	0.0%	4.8%	4.8%
Emerging specialised digital skills (2021–2024)			
Use CAE software	0.0%	5.8%	5.77%
Database	25.5%	30.7%	5.16%
Audit techniques	0.0%	4.8%	4.79%
SAP R/3	22.1%	26.8%	4.63%
Analyse business requirements	14.3%	18.6%	4.31%
Web analytics	0.3%	4.1%	3.71%
Objective-C	0.0%	2.3%	2.33%
Microsoft Access	5.8%	7.5%	1.76%
Salesforce	1.0%	2.6%	1.64%
Process data	29.5%	31.2%	1.64%

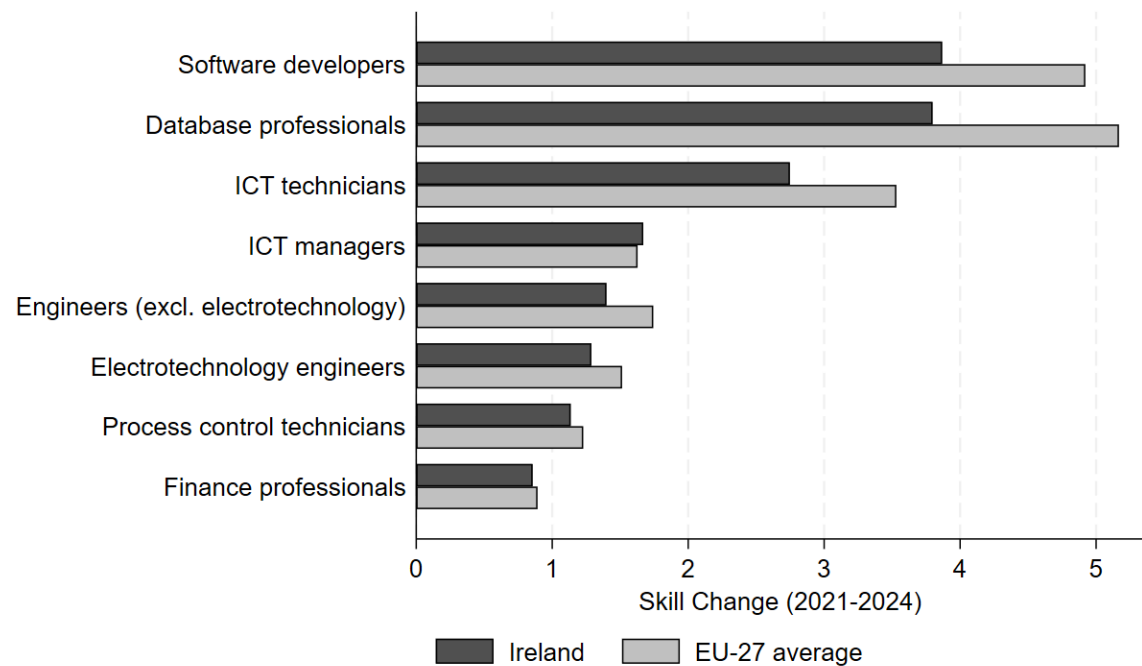
Table A15 (contd.) Finance professionals: Most important, emerging, declining and stable skills (Ireland, 2021 and 2024)

Declining specialised digital skills (2021–2024)			
Skill name	% vacancies (2021)	% vacancies (2024)	Difference (percentage points)
AngularJS	9.3%	0.0%	-9.3%
Computer programming	13.1%	9.5%	-3.6%
Tools for software configuration management	1.9%	0.0%	-1.9%
Analytics	25.1%	24.3%	-0.9%
ICT software specifications	0.6%	0.0%	-0.6%
Use IT tools	0.6%	0.0%	-0.6%
Oracle	2.9%	2.5%	-0.4%
Lims	0.3%	0.0%	-0.3%
Business intelligence	0.5%	0.2%	-0.3%
SQL	0.7%	0.4%	-0.3%
Number of vacancies	22,451	20,391	
Stable specialised digital skills (2021)			
Skill name	% vacancies (2021)	% vacancies (2024)	Difference (percentage points)
Operate relational database management system	9.8%	10.5%	0.8%
Python (computer programming)	0.4%	0.4%	0.0%
Internet of Things	0.1%	0.3%	0.2%
Tend computer numerical control lathe machine	0.2%	0.2%	0.0%
Implement a virtual private network	0.2%	0.2%	0.0%
Manage ICT virtualisation environments	0.2%	0.2%	0.0%
Virtualisation	0.2%	0.2%	0.0%
Online analytical processing	0.0%	0.1%	0.0%
Geographic information systems	0.2%	0.1%	-0.2%
Number of vacancies	22,451	20,391	

Source Lightcast, authors' calculations.

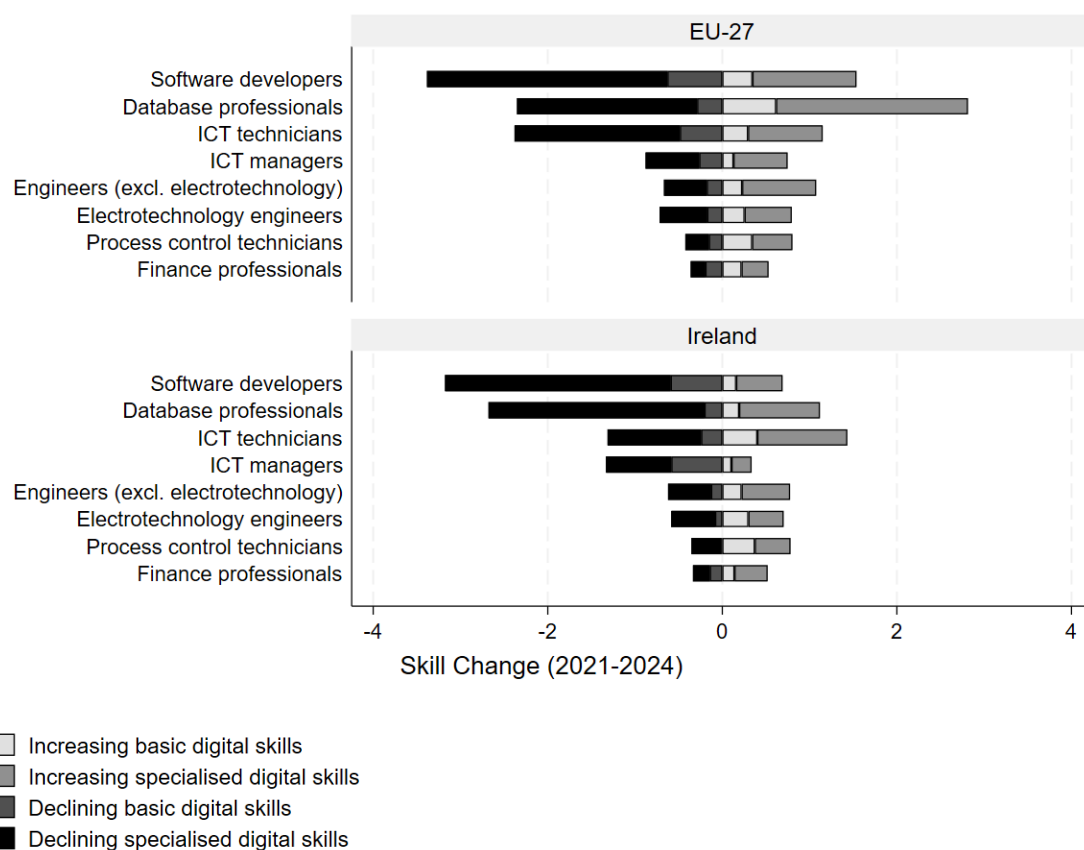
Note Stable skills limited to specialised skills that appear in both 2021 and 2024.

Figure A1 Digital skill change values (digital occupations, Ireland and EU-27, 2021–2024) (including finance professionals)



Source: Lightcast, authors' calculations.

Figure A2 Positive and negative digital skill change values (digital occupations, Ireland and EU-27, 2021–2024) (including finance professionals)



Source: Lightcast, authors' calculations.

Table B1 ICT specialists, Eurostat classification

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

Source: [Glossary: ICT specialists - Statistics Explained - Eurostat](#).

Table B2 ISCO descriptions

ISCO 08 Code	Title EN	Definition
133*	Information and communications technology service managers	Information and communications technology service managers plan, direct, and coordinate the acquisition, development, maintenance and use of computer and telecommunication systems, either as the manager of a department or as the general manager of an enterprise or organization that does not have a hierarchy of managers.
211	Physical and earth science Professionals	Physical and earth science professionals conduct research; improve or develop concepts, theories and operational methods, or apply scientific knowledge relating to physics, astronomy, meteorology, chemistry, geology and geophysics.
213	Life science professionals	Life science professionals apply knowledge gained from research into human, animal and plant life and their interactions with each other and the environment to develop new knowledge, improve agricultural and forestry production, and solve human health and environmental problems.
214*	Engineering professionals (excluding electrotechnology)	Engineering professionals (excluding electrotechnology) design, plan and organise the testing, construction, installation and maintenance of structures, machines and their components, and production systems and plants; and plan production schedules and work procedures to ensure engineering projects are undertaken safely, efficiently and in a cost-effective manner.
215*	Electrotechnology engineers	Electrotechnology engineers conduct research on and design, advise, plan and direct the construction and operation of electronic, electrical and telecommunications systems, components, motors and equipment. They organise and establish control systems to monitor the performance and safety of electrical and electronic assemblies and systems.
216	Architects, planners, surveyors and designers	Architects, planners, surveyors and designers plan and design landscapes, building exteriors and interiors, products for manufacture, and visual and audio-visual content for the communication of information. They conduct survey work to precisely position geographical features; design, prepare and revise maps; and develop and implement plans and policies for controlling the use of land.

Table B2 (contd.) ISCO descriptions

ISCO 08 Code	Title EN	Definition
241	Finance professionals	Finance professionals plan, develop, organise, administer, invest, manage and conduct quantitative analyses of either financial accounting systems or funds for individuals, establishments and public or private institutions.
242	Administration professionals	Administration professionals apply various concepts and theories related to improving the effectiveness of organisations and the individuals within the organisation.
243	Sales, marketing and public relations professionals	Sales, marketing and public relations professionals plan, develop, coordinate and implement programmes of information dissemination to promote organisations, goods and services; and represent companies in selling a range of technical, industrial, medical, pharmaceutical and ICT goods and services.
251*	Software and applications developers and analysts	Software and applications developers and analysts conduct research, plan, design, write, test, provide advice on and improve information technology systems such as hardware, software and other applications to meet specific requirements. Competent performance in most occupations in this sub-major group requires skills at the fourth ISCO skill level.
252*	Database and network professionals	Database and network professionals design, develop, control, maintain and support the optimal performance and security of information technology systems and infrastructure, including databases, hardware and software, networks and operating systems.
312	Mining, manufacturing and construction supervisors	Mining, manufacturing and construction supervisors coordinate, supervise, control and schedule the activities of workers in manufacturing, mining and construction operations.

Table B2 (contd.) ISCO descriptions

ISCO 08 Code	Title EN	Definition
313*	Process control technicians	Process control technicians operate and monitor switchboards, computerised control systems, multi-function process control machinery and maintain processing units in electrical power generation and distribution, wastewater, sewage treatment and waste disposal plants, chemical, petroleum and natural gas refineries, in metal processing and other multiple process operations.
351*	Information and communications technology operations and user support technicians	Information and communications technology operations and user support technicians provide support for the day-to-day running of communications systems, computer systems and networks, and provide technical assistance to users.
741	Electrical equipment installers and repairers	Electrical equipment installers and repairers install, fit and maintain electrical wiring systems and related equipment, electrical machinery and other electrical apparatus and electrical transmission and supply lines and cables.

Source: International Standard Classification of Occupations (ISCO), available at: <https://ilostat ilo.org/methods/concepts-and-definitions/classification-occupation/>.

Note: Occupations with * classified as digital occupation in our study.

Table B3 Digital occupations, european and Irish digital index score (2021)

ISCO code	ISCO 3-digit occupation	Digital index score (all EU-27 countries)	Digital index score (Ireland)
133	ICT service managers	12	14.4
251	Software and applications developers and analysts	11.9	12.6
252	Database and network professionals	10.5	9.1
351	ICT operations and user support technicians	10	9.9
215	Electrotechnology engineers	8.8	--
241	Finance professionals	7.7	9.8
214	Engineering professionals (excluding electrotechnology)	7.7	8.5
243	Sales, marketing and public relations professionals	7.6	6.7
242	Administration professionals	7.2	8.2
216	Architects, planners, surveyors and designers	7	--
213	Life science professionals	6.9	--
211	Physical and engineering science technicians	6.4	--
312	Mining, manufacturing and construction supervisors	6.2	--
313	Process control technicians	4.8	--
741	Electrical equipment installers and repairers	4.4	--

Source: The digital index score is calculated using the 2021 European Skills and Jobs Survey.

Note: '--' denotes an occupational category where the sample size was too small to determine a digital index value.

Table B4 Wald tests by occupation class, across tech change category pairs

Comparison	Middle 33%	Top 33%	DFHERIS	Joint (all 3)
TC vs destruction	7.68***	1.88	10.73***	15.95***
TC vs creation	7.24***	3.06*	0.47	8.72**
TC vs both	2.2	0.01	0.02	5.63
Destruction vs creation	21.58***	6.88***	12.89***	26.46***
Destruction vs both	2.76*	2.03	9.85***	10.58**
Creation vs both	15.94***	2.72*	0.67	22.68***

Notes: Table reports Wald χ^2 test statistics for the null hypothesis that a given occupation class coefficient (or, for the 'Joint' column, all three occupation class coefficients simultaneously) is equal across the two technological change categories being compared, using the multinomial logit estimates reported in Table 5.3. $\chi^2(1)$ for individual occupational tiers (Middle 33%, Top 33%, DFHERIS, each tested against the 'Bottom 33%' base category); $\chi^2(3)$ for the Joint column, which tests equality of all three tiers simultaneously. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. DFHERIS: Department of Further and Higher Education, Research, Innovation and Science.



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