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Employment and labour markets

Measures to tackle labour shortages: Lessons for future policy

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Eurofound

European Foundation for the Improvement of Living and Working Conditions

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Abbreviations

AI	artificial intelligence
Cedefop	European Centre for the Development of Vocational Training
CMO	context–mechanism–outcome
ESF	European Social Fund
EWCTS	European Working Conditions Telephone Survey
GHG	greenhouse gas
GP	general practitioner
ICT	information and communication technology
ISCED	International Standard Classification of Education
IT	information technology
NEET	not in employment, education or training
NGO	non-governmental organisation
O*NET	Occupational Information Network
OECD	Organisation for Economic Co-operation and Development
PES	public employment services
RCT	randomised controlled trial
SMEs	small and medium-sized enterprises
STEM	science, technology, engineering and mathematics

Country codes EU27

AT	Austria	ES	Spain	LV	Latvia
BE	Belgium	FI	Finland	MT	Malta
BG	Bulgaria	FR	France	NL	Netherlands
CY	Cyprus	HR	Croatia	PL	Poland
CZ	Czechia	HU	Hungary	PT	Portugal
DE	Germany	IE	Ireland	RO	Romania
DK	Denmark	IT	Italy	SE	Sweden
EE	Estonia	LT	Lithuania	SI	Slovenia
EL	Greece	LU	Luxembourg	SK	Slovakia

Executive summary

Introduction

A strong labour market recovery in the aftermath of the COVID-19 pandemic, together with ongoing demographic trends, have exacerbated labour shortages in the EU. By the third quarter of 2022, the average EU vacancy rate had reached historic highs of close to 3%, with nearly a third of EU employers reporting that these shortages are a factor limiting production and service delivery – the fight for talent being most acute in countries like Austria, Belgium, Czechia, Germany and the Netherlands. Sectoral differences are also evident: shortages in healthcare and the information and communication technology (ICT) sector have been exacerbated by the pandemic. With the ending of most restrictions, labour market tightness also increased in sectors such as hospitality and retail, which were particularly affected by lockdowns and had shed labour, as many workers found employment in sectors with better working conditions. The impact of the green and digital transition increasingly influences skills mismatches, contributing to a shortage of appropriately skilled labour, as digital skills in particular are increasingly becoming core skills.

Labour market slack was at the lowest level in a decade in late 2022, again displaying variations between countries and demonstrating that there are still opportunities to integrate underutilised labour into the labour market.

Policy context

The importance of tackling labour shortages has been recognised by EU institutions, national governments and social partners, and is reflected in many country-specific recommendations. A wide range of EU initiatives affect and target this complex phenomenon, including in relation to the green and digital transition, skills, mobility and migration. The European Commission has declared 2023 the European Year of Skills to further emphasise the importance of initial and ongoing skills development to meet Europe's labour market requirements.

Key findings

- The main drivers of labour shortage differ by sector, occupation and region. Measures to address them must respond to these drivers by increasing the attractiveness of certain sectors and occupations, activating underutilised labour, and better matching supply and demand by enhancing the use of existing labour and retaining labour.
- Labour shortages are particularly evident in sectors with challenging working conditions, such as health and long-term care. This factor, together with low levels of investment, the impact of the pandemic and a gender-segregated labour market, contribute to the shortage of health and long-term care workers. Shortages in these sectors are likely to intensify in the next few years due to the ageing of the population and the workforce in the sector. This is particularly significant, as gaps in these sectors can have further knock-on effects on shortages in other sectors if bottlenecks arise in the treatment of health conditions.
- Most of the measures to address shortages in the health and long-term care sectors focus on pay and working conditions. Although initiatives to tackle the issue of low wages in some central and eastern European countries have managed to cut down on the number of applications to have qualifications recognised for work abroad, initiatives focusing on pay across the board can be insufficient to attract workers to more remote towns and villages, due to poorer healthcare as well as more limited educational infrastructure and other quality of life factors. Specific payments to attract healthcare professionals to such regions have shown some impact. However, focussing on pay alone is often insufficient without other interventions to increase the attractiveness of working and living conditions. Other working conditions related factors, such as greater autonomy over working hours, access to training and career progression and more meaningful work, also have an important role to play.
- In the ICT sector, the main driver of shortages relates to a lack of foresight and poor matching of skills supply and demand. The low representation of women is an additional contributing factor. In 2022, 6% of European enterprises had hard-to-fill vacancies for jobs requiring ICT specialist skills, 3.4 percentage points more than in 2014. As a result, measures tend to focus on raising awareness of relevant careers, providing female role models and delivering training to girls and women. Some initiatives aimed at migrant and other vulnerable groups of women also include supporting measures to allow women to access the labour market – for example childcare support.
- In both the health and ICT sectors, another focus of measures to target underutilised labour revolves around integrating migrants and refugees. This is done by implementing streamlined systems to assess and accredit qualifications gained abroad and offering short, modular training to deliver any additional content required for accreditation in the host country, as well as language training.
- Measures to enhance the use of existing labour are present in all sectors and skills gaps, but arguably play a more important role in ICT and in relation to the green and digital transition, where skills mismatch is a more significant driver of shortages. Given ongoing technological developments and the need for the clear identification of future skills needs in a greening economy, joint working between governments, social

partners and training providers to identify existing skills needs and forecast future ones and to match these with the content and supply of training has an important role to play.

- The role of social partners and other key stakeholders is critical in ensuring that these efforts are closely related to broader strategies to develop particular sectors at the national and regional level, to reach climate targets and to ensure the delivery of required skills. In relation to green skills and jobs, the emphasis tends to be on 'market/demand building' and the development of an initial understanding of the skills to be included in new curricula, for example in the construction sector.
- A key challenge here is the lack of a clear definition and associated training for green jobs and skills. Not least as a result of the commitments of the Fit for 55 package, demand for such skills is set to grow. Certain sectors and occupations are likely to be particularly affected, with some – such as the construction sector – already experiencing significant labour shortages. Without policy intervention, this is likely to be exacerbated, as demand for the use of renewable technologies and retrofitting grows in business and domestic settings, in part driven by the regulatory agenda.
- Research highlights the need for support for micro and small enterprises to identify skills gaps, and to provide flexible and affordable training for managers and workers.
- Despite the increasing emphasis in recent decades on the need for evidence-based policymaking, high-quality policy evaluation remains sparse. Around 65% of the evaluated policies covered by this study had only basic or incomplete evidence available to assess impact.

Policy pointers

- Effective policy design requires good baseline information on the exact nature and drivers of shortage and the slack in the labour market. This enables the precise targeting of measures to enhance attractiveness, make use of underutilised resources and ensure the better matching of skills demand and supply.
- Key stakeholders including social partners, companies and training providers should be involved in defining specific skills requirements and training content on an ongoing basis, ideally embedded in stable structures. National-level sectoral social partners have a critical role to play in addressing factors linked to pay and working conditions which are the key drivers of shortages in a number of sectors featuring high levels of vacancies.
- Measures targeting under-utilised groups in the labour market should provide wrap-around support to target not only training and work experience requirements, but also other factors that might impede labour market entry (such as health issues and lack of access to affordable care infrastructure). This requires collaboration with social partners and must be implemented in the context of broader support measures, including work–life balance policies, tax and benefit incentives.
- Efforts are required to overcome stereotyping or attitudinal barriers among pupils (and parents), students, workers and employers, which can prevent entry to certain training and career paths, recruitment of specific groups or take-up of training by women in male-dominated professions and vice versa.
- Effective green transitions require better knowledge and data around the definition of green jobs and green skills to be able to operationalise and regularly update relevant training measures.

Introduction

The EU labour market has recovered quickly from the impact of the COVID-19 pandemic, not least due to the EU and national policy measures implemented to protect business and workers from the impact of the enforced (partial) closure of large segments of the economy, followed by significant investment to boost the post-pandemic recovery. Despite the uncertainty created by the economic shock resulting from Russia's invasion of Ukraine and its implications for the supply and price of energy and goods, aggregate job creation remained strong.

These conditions have contributed to increasing labour shortages (see Box 1 for definition), and which the pandemic served to accentuate in some sectors, for example healthcare and information and communication technology (ICT) services (Eurofound, 2021). In other parts of the economy, the impact of the pandemic resulted in a shrinking of the labour force and caused acute labour shortages as sectors began to reopen (such as in the retail and hospitality sectors).

In late 2022, job vacancy rates reached unprecedented highs, with ongoing demographic trends raising concerns that recruitment challenges could intensify further in certain sectors, occupations and regions. The fight for talent and the resulting challenges for growth and competitiveness are high on the EU policy agenda.

The European Commission's proposal for its 2023 joint employment report states that 'labour and skills shortages have exceeded pre-pandemic levels in several EU countries, highlighting the importance of strengthening active labour market policies and upskilling and reskilling in particular' (European Commission, 2022a). Recommendations to reduce skills mismatches and improve active labour market policies have featured among the country-specific recommendations addressed to most EU Member States in recent years.[1]

Box 1: Definition of labour shortages used in the context of this report

Labour shortages arise when the demand for workers in an occupation exceeds the supply of workers available possessing the required skills and willing to work at a specific wage rate and in specific working conditions in a particular place and point in time (Eurofound, 2021).

It is possible to distinguish between quantitative and qualitative labour shortages.

- **Quantitative shortages:** These may result either from phases of strong economic growth or from increased demand for specific goods or services, which could lead to (near) full employment. Another factor could be the reduction in the working age population, linked to migration, demographic ageing and activity/inactivity rates among certain population groups.
- **Qualitative labour shortages:** These are caused by mismatches between labour demand and labour supply. They can include mismatches in skills, job preferences, lack of information about vacancies or regional distribution of labour.

In addition to this classification, it is also possible to distinguish between cyclical and structural shortages (European Commission, 2015).

- **Cyclical labour shortages:** Skills mismatches will always exist as a part of the frictional dynamics of the labour market and/or business cycles. In the short to medium run, skills demand varies with business cycle conditions.
- **Structural labour shortages:** New sectors and jobs continuously emerge while others shrink. Some structural changes, such as the adoption of new technologies, may increase the demand for certain skills that are not available in the labour market in the short run, creating skills shortages even when unemployment is high. At the same time demographic changes, migration patterns and the nature of working conditions can have impacts on both the supply of and demand for labour, contributing to a situation of persistent structural imbalance.

This report builds on the findings of a Eurofound study published in 2021, which mapped the scale, scope and nature of labour shortages in the EU Member States. The earlier report explored the drivers of shortage and developed a categorisation of measures adopted in different Member States to address the most important shortages at sectoral, occupational and geographical levels (Eurofound, 2021).

In order to inform policymakers about suitable measures that can be taken in different contexts to address labour shortages, Eurofound carried out a review of evaluated policy measures to assess their effectiveness, efficiency and potential transferability. That review forms the basis of this report. In line with the 2021 report, the research also focused on those sectors and skills in which shortages were seen to have been exacerbated by

1 For more information, see the EU's country-specific recommendations database, available at https://ec.europa.eu/economy_finance/country-specific-recommendations-database/

the COVID-19 pandemic (health and care, ICT) and have been particularly affected by the twin green and digital transition. Since the lifting of public health restrictions, shortages in other sectors have also (or again) become more prominent, including in transport, manufacturing, construction and hospitality, but the focus of this report is on sectors with long-standing structural shortages aggravated by the pandemic and on green and digital skills – with the latter in particular increasingly becoming a core skill across occupations.

Following a brief update on the situation regarding the scale of labour shortages, this report reflects on the policy lessons of 40 evaluated policies that aimed to contribute to tackling shortages in 22 Member States. It also assesses the quality of existing policy evaluations and emphasises the importance of building in a clear intervention logic and evaluation methodology to ensure a process of evidence-based policymaking – especially important at a time of significant pressure on the labour market and on public finances.

Policy context

The issue of labour shortages is a cross-cutting one, linked to a wide range of EU regulations and policies. In particular, it is affected by the EU's green and digital agendas. Of high policy relevance are initiatives in the field of active labour market policy, education and training, as well as mobility and migration. The EU has declared 2023 the European Year of Skills, with the aim of providing further momentum towards the EU 2030 social targets of at least 60% of adults in training every year and at least 78% in employment, and the 2030 Digital Compass targets of at least 80% of adults with basic digital skills and 20 million employed ICT specialists in the EU.

More broadly, the European Skills Agenda, launched in 2020, provides the framework for EU skills policy collaboration and sets a range of quantitative objectives for reskilling and upskilling to be achieved between 2020 and 2025 (European Commission, 2020a; see Box 2).

Box 2: European Skills Agenda for sustainable competitiveness, social fairness and resilience

The European Skills Agenda is a five-year plan to help individuals and businesses develop more and better skills and to put them to use, by:

- strengthening sustainable competitiveness, as set out in the European Green Deal
- ensuring social fairness, putting into practice the first principle of the European Pillar of Social Rights: access to education, training and lifelong learning for everybody, everywhere in the EU
- building resilience to react to crises, based on the lessons learnt during the COVID-19 pandemic

The European Skills Agenda sets objectives to be achieved by 2025, including:

- 50% participation of adults aged 25–64 in learning during the last 12 months
- 30% participation of low-qualified adults aged 25–64 in learning during the last 12 months
- 20% of unemployed adults aged 25–64 with a recent learning experience
- 70% of adults aged 16–74 having at least basic digital skills

To implement the actions and meet the objectives of the European Skills Agenda, the EU will need additional public and private investments in skills estimated at around €48 billion annually. The Commission's proposal for NextGenerationEU provides significant resources as part of a major budgetary initiative to tackle the economic and social consequences of the crisis.

Source: *European Commission (2020a)*

The EU has also introduced various measures aimed at attracting and retaining workers from outside Europe. The New Pact on Migration and Asylum published in September 2020 included plans to enhance legal pathways into the EU, via new 'talent partnerships' (European Commission, 2020b). It also intends to relaunch negotiations to reform the Blue Card Directive to attract highly skilled workers. More recently, there have been policy initiatives at EU level to make it easier for highly skilled and qualified migrants from other countries to remain in the EU. With specific reference to those fleeing Russia's invasion of Ukraine, a Talent Pool initiative was launched via the European Labour Authority's EURES network in October 2022.

In addition to this, the EU's new Industrial Strategy outlines the pillars of action for Europe's green and digital transition, with an emphasis on a more circular economy (European Commission, 2021a). Among other elements, the strategy emphasises the need for skilling and reskilling to meet the targets set and to capitalise on the employment creation potential within the context of a changing economy. Related to this strategy, and within the initiative 'Shaping Europe's digital future', several policies are intended to promote the digital economy at all levels, including programmes to increase digital skills in the workforce, both for the ICT-related sectors and for the digitalisation of activities of all economic sectors (European Commission, 2020c). Moreover, the EU's Green Deal emphasises the efficient use of resources by moving

to a clean, circular and decarbonised economy, with a greater focus placed on measures related to the green transition, including the provision of future-proof jobs and skills training for the transition (European Commission, 2019a). The European Commission's *Green deal industrial plan for the net-zero age* also refers to the importance of addressing labour shortages in sectors linked to the green transition (European Commission, 2023a). The NextGenerationEU recovery instrument, which is devoting €806.9 billion across Europe to investments significantly related to these areas, is expected to be used to further this twin transition, including the development of training and skills actions and initiatives to increase and upgrade the existing supply of skilled workforce. In relation to this, there are action plans linked to the Recovery and Resilience Facility and informed by the country-specific recommendations to individual Member States on the need for upskilling and reskilling.

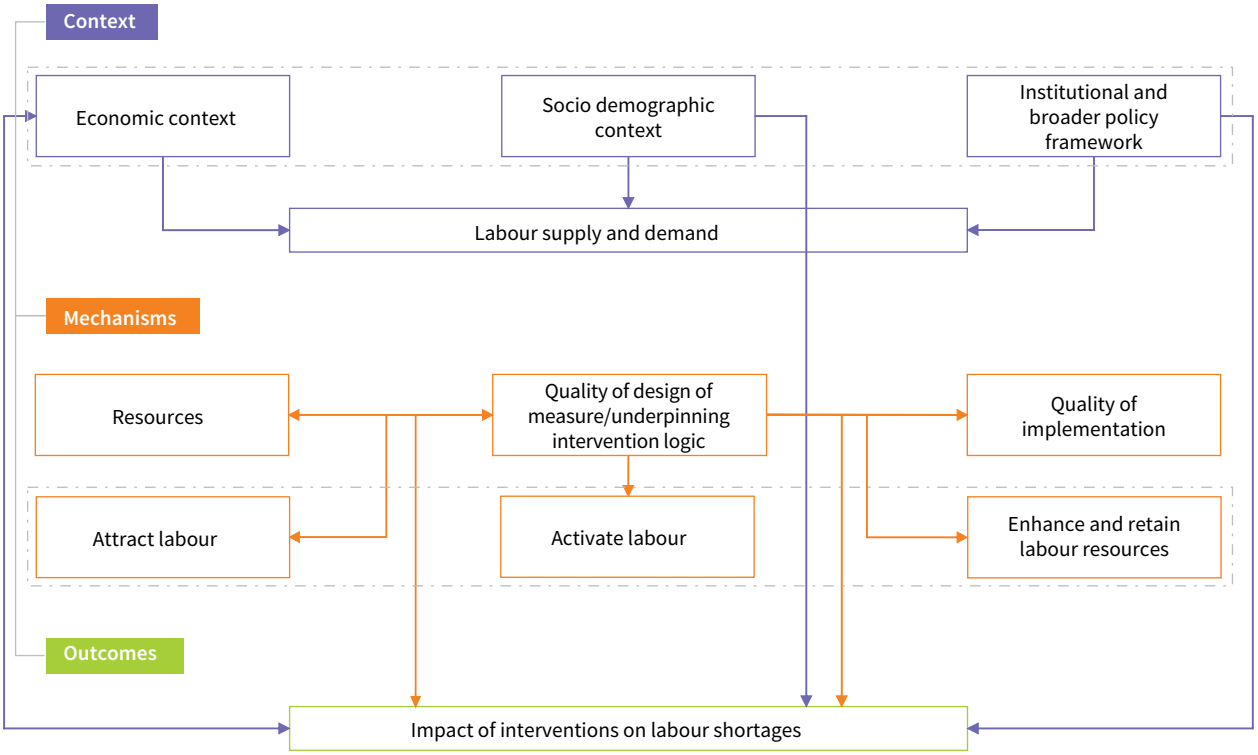
The European Care Strategy, presented in September 2022, calls for quality, affordable and accessible care services across the EU. It considers the need to address expected labour needs to keep long-term care coverage at the equivalent level to now (estimated at around 1.6 million long-term care workers to be added by 2050) (European Commission, 2022b).

The importance of social partner involvement in ensuring the EU's green and digital transition has also been underlined by the European social dialogue work programme 2022–2024, which was signed by the EU social partners in June 2022 (ETUC et al, 2022). This has also been highlighted by the European Social Partners' Framework Agreement on Digitalisation, signed on 22 June 2020, according to which social partners can play a supportive role for enterprises in relation to, among other things, training/reskilling/upskilling in the face of ongoing and future changes such as the digital transformation of today's economy (ETUC et al, 2020). In its Communication on *Strengthening social dialogue in the European Union: harnessing its full potential for managing fair transitions*, the European Commission also emphasises the importance of collaboration between the Commission and the social partners on key topics such as labour shortages and the vital role played by social partners and addressing such issues (European Commission, 2023b).

Methodology

The research for this report is based on the context–mechanism–outcome (CMO) methodology (Figure 1), which aims to explain the linkages between policy measures, their implementation mechanisms (M), the context within which they operate (C) and the outcomes they achieve (O) (Pawson and Tilley, 1997).

Figure 1: CMO framework in relation to assessing measures to tackle labour shortages



Source: *Authors*

In relation to measures that – at least among their goals – seek to address labour shortages, the three dimensions (context, mechanisms, outputs) can briefly be described as follows.

The **context** reflects the reality into which an intervention is introduced. This refers to the scale, scope and precise nature of the identified labour shortages, their drivers, and the general socioeconomic and policy frameworks in place, including:

- **economic context** such as trends in gross domestic product, level of unemployment, and the influence of unexpected events such as the pandemic, war in Ukraine and increases in energy prices
- **sociodemographic context**, for instance, societal and demographic trends including migration; family patterns and geographical mobility; and the influence of unexpected events
- **institutional and broader policy framework**, in particular existing labour market institutions at European, national and regional/local levels; level of decision-making; industrial relations system and existence of active social dialogue; employment and social policy framework such as the existence of active labour market policies, their nature and expenditure on them; migration policies; availability of support measures for work–life balance; and existence of affordable, accessible high-quality care facilities

Mechanisms are the way a certain policy or intervention functions in each context, generating a set of outcomes. In that sense, the mechanisms of a certain programme include the type of interventions as well as the processes and activities of stakeholders, their responses to the intervention in question, and the quality of the design and implementation of these measures. Three main types of intervention were outlined in Eurofound's 2021 report (see Table 1).

Table 1: Categorisation of policies to address labour shortages

Types of measures	Examples of policy interventions
Attracting labour	1. Enhancing the attractiveness of certain sectors or professions by improving wages and/or working conditions. 2. Enhancing the attractiveness of living and working conditions in the country/region. 3. Creating an active migration policy that combines foresight, systems for the recognition of qualifications and capacities, anti-discrimination policies and attracting returning migrants. 4. Improving recruitment strategies at company level and the marketing and attractiveness of the sector/company.
Activation of underutilised resources	1. Addressing labour market barriers for various groups that are currently long-term unemployed or inactive (for example, addressing access to care services, addressing barriers linked to health or other issues, enhancing the recognition of qualifications for migrants, adjusting workplaces for older workers or workers with disabilities, addressing discrimination).
Enhancing the use of existing labour and retaining labour	1. Improving matching between supply and demand (for example, better skills forecasting, better links between forecasting/business needs and training provisions, the involvement of social partners in curriculum development, the regular updating of curricula). 2. Addressing skills and competence gaps (for example, work experience, long/short training, recognition of skills). 3. Improving matching services. 4. Enhancing preparations for labour market change among employees through ongoing needs assessment and lifelong learning. 5. Preventing (early) exit by protecting work ability (for example, through health and safety measures, ongoing training, improving job quality) and access to reintegration services after illness or absence.

Source: *Eurofound, 2021*

Outcomes are the results or effects produced by the interaction between contextual conditions and the implemented measure's mechanisms, in terms of the ability of the measure to attract, better utilise or enhance/retain labour, and as a result to help reduce labour shortages.

Forty policy measures from 22 countries were selected from a longlist based on the quality of evaluation evidence available and aiming for a relatively balanced representation between geographical contextual settings and types of measures employed. The selected policies also had to be in place for a certain time (at least 12 months) to ensure that sufficient monitoring or evaluation data would be available. Table 2 presents an overview of the selected measures, which will be discussed in more detail in Chapters 2–4 below. A more detailed table, including the full titles of the 40 measures, details of temporal scope, average annual budget and lead organisation, can be found in the annex at the end of the report.

These policies, of course, only constitute a small selection of policy measures aimed at contributing to reduce labour

shortages at Member State level and must be seen in the broader context of other measures and approaches to dealing with such shortages. The focus on evaluated measures also means that some types of measures are not represented in this research but are nonetheless relevant: examples include initiatives supporting the recruitment of third-country nationals, measures to improve care provisions, broader work–life balance measures, encouraging the retention and reintegration of older workers and other under-represented groups such as workers with disabilities, and incentives through the tax and benefit system to make work pay.

Table 2: Overview of 40 analysed measures by sector/occupation targeted

Country	Short name of measure	Sector/occupation targeted
Austria	FIT	ICT sector*
	klimaaktiv	Occupations affected by green transition
	FKS	ICT sector Health and care sectors*
Belgium	Interface3	ICT sector
	STEM Action Plan and Agenda	ICT sector*
Bulgaria	Adverse working conditions payment for GPs	Health and care sectors
Cyprus	Multi-company training programmes	Occupations affected by digital transition*
	WE-Qualify	Occupations affected by green transition
Denmark	Technology Pact	Occupations affected by digital transition
	AMU	Occupations affected by green transition*
Estonia	Vali IT!	ICT sector
Finland	Finland's Age of Artificial Intelligence	Occupations affected by digital transition
France	GEN	ICT sector
	Skills Investment Plan	Occupations affected by digital transition
Germany	KAP	Health and care sectors
	IQ	Health and care sectors*
	ReDI School of Digital Integration	ICT sector
	Jobstarter plus	Occupations affected by digital transition*
	WeGebAU	Health and care sectors*
Greece	Digital Marketing Programme	Occupations affected by digital transition
	Grow with Google	Occupations affected by digital transition
Ireland	Skillnet Ireland	ICT sector*
	Just Transition Plan	Occupations affected by green transition
Italy	Growing in Digital	Occupations affected by digital transition
	Tertiary Technical Education	Occupations affected by digital transition
Latvia	Support to attract medical practitioners outside Riga	Health and care sectors
	LITKA project I	ICT sector
	LITKA project II	ICT sector
Luxembourg	Luxembourg Digital Skills Bridge	Occupations affected by digital transition
Netherlands	Health Workforce Planning	Health and care sectors
	Buurtzorg Model of Care	Health and care sectors
Poland	IT for SHE	ICT sector
Portugal	Academia de Código Bootcamps	ICT sector
Romania	2018 wage increase	Health and care sectors
Slovakia	You Too in IT	Occupations affected by digital transition
Slovenia	Programme for Transition to Green Economy	Occupations affected by green transition
Spain	PAIME	Health and care sectors
	Green Jobs Programme	Occupations affected by green transition
Sweden	National Digitalisation Strategy for the School System	Occupations affected by digital transition
	Fast Track	Health and care sectors*

Note: **These sectors/occupations are among a broader range of sectors targeted. This means that the budget data provided can cover a broader measure.*

Source: *Authors*

1 Labour shortages in the aftermath of COVID-19

Introduction

The labour market's recovery in the aftermath of the COVID-19 pandemic has been strong, if uneven, across countries and labour market groups. By the second quarter of 2022, aggregate employment in the EU had surpassed pre-pandemic levels. This growth has been faster for women than for men, a trend that characterised European labour markets prior to the onset of the pandemic. Overall, in the second quarter of 2022, there were an additional 2.8 million women and 2.5 million men in employment compared with the same quarter of 2021. In parallel, shifts in average unemployment levels have remained relatively muted both during the pandemic and in its aftermath. Unemployment levels remained stable, especially for prime age workers, while being more volatile for younger age groups, whose labour market prospects deteriorated substantially because of the pandemic.

Aggregate job creation remained strong despite the economic shock produced by Russia's invasion of Ukraine. Against this backdrop, labour shortages became the key phenomenon affecting European labour markets in the short and medium terms. The reasons for the increase in labour shortages are varied. Long-term trends such as demographic ageing contribute to the phenomenon by reducing the supply of workers while also driving up demand for labour in specific sectors such as health and long-term care. Similarly, in the medium and long terms, the green and digital transition will increase demand for specific skills and occupations, also leading to a structural shift in the growth model of the European economy. The extent to which these transitions will contribute to labour shortages will depend on the effectiveness of active labour market policies to address skills mismatches.

The pandemic itself also contributed to the tightness of European labour markets. In the recovery phase, European companies competed to attract labour in response to growing demand for products and services. This was especially the case in the construction and manufacturing sectors, which are more responsive to upswings in the business cycle. The growth in employment in the manufacturing sector was, however, dampened in the second half of 2022 by the emergence of supply chain bottlenecks and the energy crisis triggered by Russia's invasion of Ukraine (European Commission, 2022c). Job creation has also been strong in sectors where telework was possible during the pandemic (Eurofound, 2022b). For example, the ICT sector, a sector affected by structural labour shortages, added 1.06 million jobs between 2019 and 2021.

The pandemic also contributed to labour shortages by shrinking the labour force, especially in contact-intensive sectors such as retail and hospitality. By the end of 2021, these sectors still had a deficit of around 1.4 million workers compared with the last quarter of 2020 (Eurofound, 2022b). This could reflect health concerns as well as a change in workers' preferences; given the tight labour market and the availability of jobs in other sectors, some workers might be moving away from low-paid, poor quality jobs (IMF, 2022).

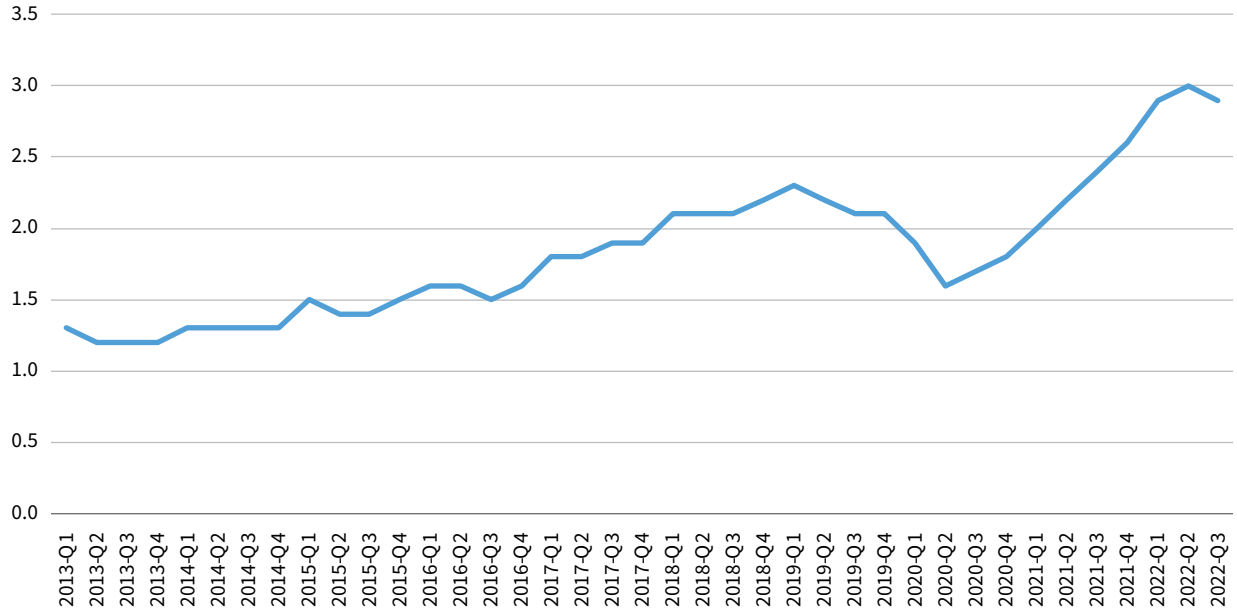
The remaining part of this chapter provides comparative evidence about labour shortages across EU Member States before and after the onset of the COVID-19 pandemic. It emphasises the continuity between trends in shortages that had consolidated prior to the pandemic and the more recent developments that have emerged against the competing pressures of the economic recovery, supply chain bottlenecks and the war in Ukraine. The last three sections of the chapter zoom in on the specific nature of labour shortages in the areas that are the focus of this report: healthcare, ICT and digital skills, and activities affected by the transition to a green economy.

Trends in labour shortages across the EU

The strong recovery in European labour markets from the COVID-19 pandemic has been accompanied by a steep rise in labour shortages. By the third quarter of 2022, the scale of shortages in the EU as captured by the job vacancy rate stood at 2.9% – more than double the level in the same quarter of 2013, and 0.8 percentage points above the vacancy rate in the third quarter of 2019, prior to the COVID-19 pandemic. As Figure 2 (next page) shows, labour shortages in the EU had been increasing between 2014 and 2019, and especially after 2015, when the recovery from the earlier global financial crisis gained momentum. While the pandemic and the associated lockdowns subdued economic activity and reversed the trend of growth in labour shortages, this was short-lived. By the second quarter of 2021, the vacancy rate in the EU already matched pre-pandemic levels, and it reached historic highs by the second quarter of 2022.

Figure 2 also shows that, amid growing challenges posed by the war in Ukraine, supply chain bottlenecks, the energy crisis and inflationary pressures, the vacancy rate registered a slight decline between the second and third quarters of 2022. Still, given the scale of these concomitant challenges, this change is modest, indicating that European labour markets remain tight and are likely to remain so despite the predicted moderate recession, which is likely to affect the EU and in particular the Eurozone in 2023 (European Commission, 2022c). The persistence of labour shortages amid a potential recession indicates that they are likely to become structural and remain high in the coming years and could be exacerbated as a result of demographic trends.

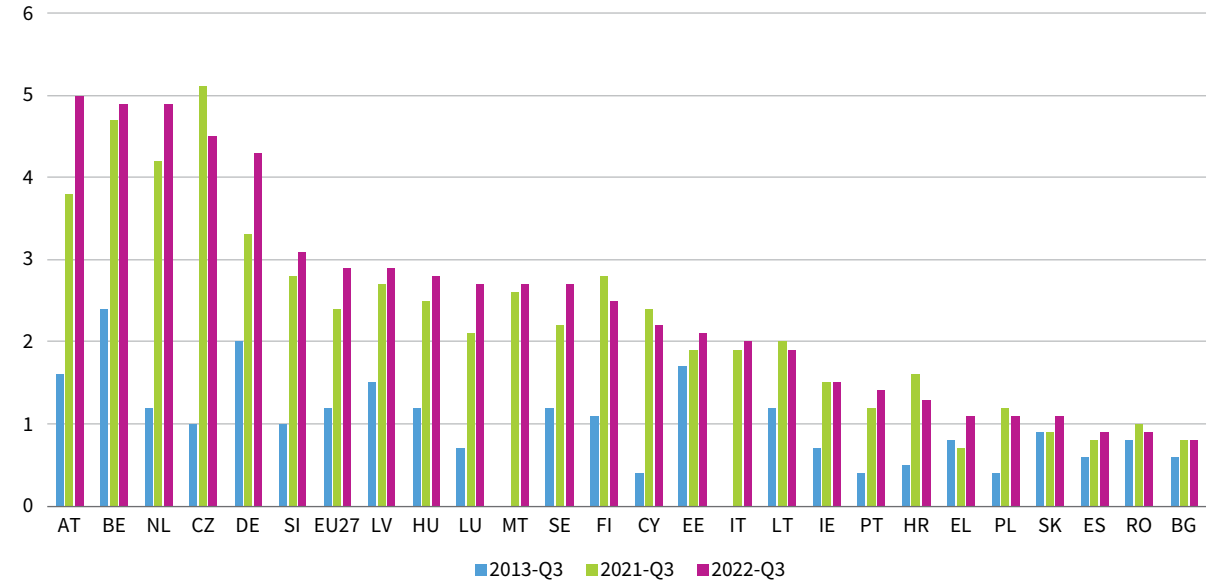
Figure 2: Job vacancy rate, EU27, Q1 2013 to Q3 2022 (%)



Source: *Authors, based on Eurostat, Job vacancy statistics by NACE Rev. 2 activity – quarterly data (from 2001 onwards) [jvs_q_nace2], adjusted data*

However, the level of labour shortages as captured through the vacancy rate registers a high degree of variation between countries (Figure 3). Within the EU, three groups of countries can be broadly identified. First, there are countries where shortages have seen very large increases in the past decade and where the vacancy rate is currently above 4%. This is the case in Austria, Belgium, Czechia, Germany and the Netherlands. Czechia is the only country in this group that registered a decline (of 0.6 percentage points) in vacancy rates as a result of the decline in economic activity triggered by the energy crisis, which negatively impacted its manufacturing and construction sectors. Still, as of the third quarter of 2022, the vacancy rate in Czechia remains one of the highest in Europe, which indicates that shortages in the country are structural in nature. The second group includes Cyprus, Estonia, Finland, Hungary, Italy, Latvia, Luxembourg, Malta, Slovenia and Sweden. These are countries where the vacancy rate in the third quarter of 2022 hovered between 2% and 3%, in line with the European average. In the third group, which includes Bulgaria, Croatia, Greece, Ireland, Lithuania, Poland, Portugal, Romania, Slovakia and Spain, the vacancy rate is lower than 2%. In this group, the vacancy rate has registered only small increases in the past decade, with high levels of unemployment and informal employment rather than widespread labour shortages being the key labour market issues.

Figure 3: Job vacancy rates, EU27, Q3 2013, Q3 2021 and Q3 2022 (%)

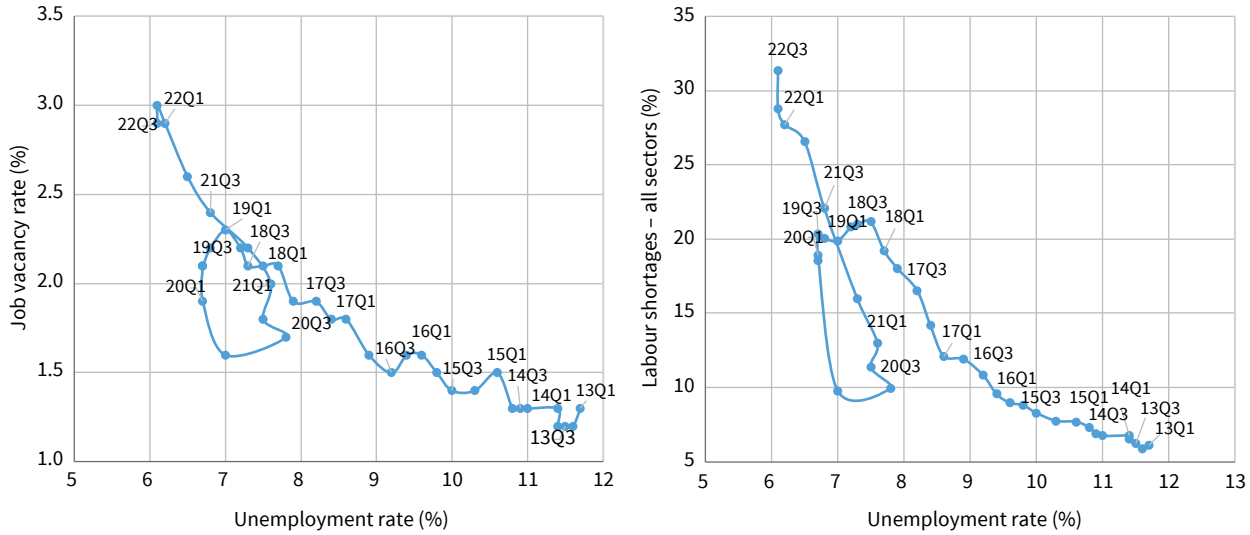


Notes: *Data for Denmark and France are not available. The last data available for Portugal are from Q2 2022.*

Source: *Authors, based on Eurostat, Job vacancy statistics by NACE Rev. 2 activity – quarterly data (from 2001 onwards) [jvs_q_nace2], adjusted data*

Figure 4 plots two versions of the Beveridge curve: one based on the vacancy rate indicator described above, and one based on a survey measure that captures the share of companies in the economy indicating that labour is a factor limiting production. The two indicators display similar patterns. In the aftermath of the global financial crisis, the Beveridge curves shifted left, indicating increased average efficiency in European labour markets and better matching between jobseekers and vacancies. Both measures dropped in the first and second quarters of 2020 while the level of unemployment remained stable. This is consistent with evidence from past business cycles, which indicates that unemployment levels respond to changes in the economy with a lag (Kiss et al, 2022). Starting with the second quarter of 2020, the unemployment level registered a small increase followed by small variations explained by the effects of lockdowns on European labour markets. Two additional aspects are worth noting. First, the two indicators do not provide evidence of a deterioration of average matching performance in the European labour markets, as the two Beveridge curves did not move upwards. Second, as evidenced by the small downturn in the third quarter of 2022, the vacancy rate seems to have outpaced the business sentiment (regarding the effects of shortages) in revealing the labour market effects of the macroeconomic and geopolitical factors that impacted on European labour markets during 2022.

Figure 4: Job vacancy rate and labour shortages as a factor limiting production (EU27), illustrated by the Beveridge curve

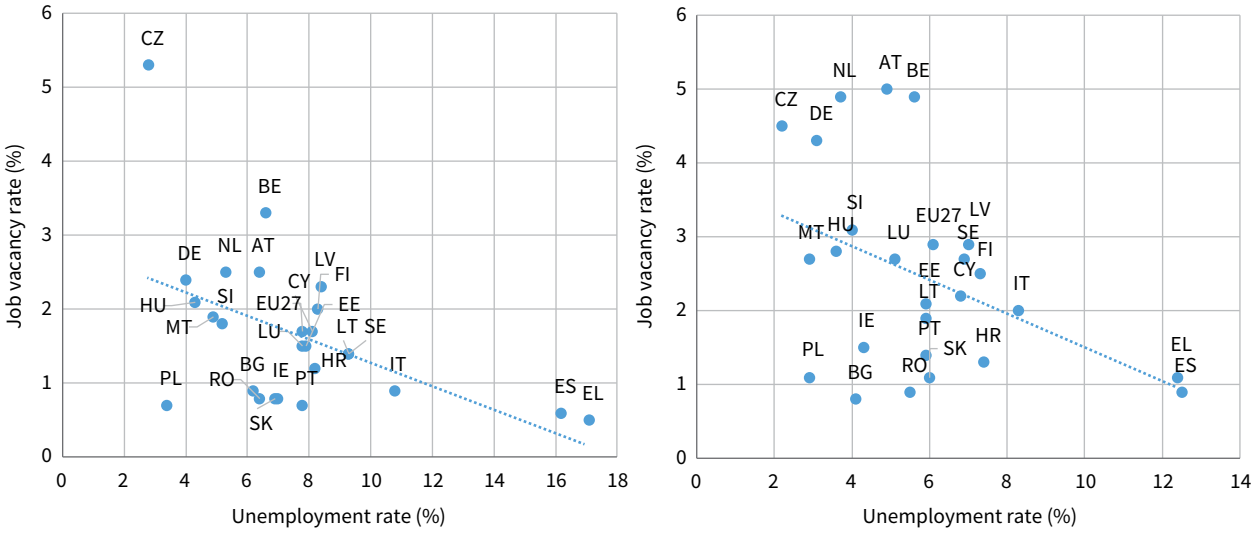


Note: *Shortened forms of years are used: e.g. '13' for '2013'.*

Source: *Authors, based on Eurostat, Job vacancy statistics by NACE Rev. 2 activity – quarterly data (from 2001 onwards) [jvs_q_nace2]; European Business and Consumer Survey, Directorate-General for Economic and Financial Affairs, and Unemployment by sex and age – quarterly data [une_rt_q], seasonally adjusted data*

To further gauge the heterogeneity of labour market developments in the EU, Figure 5 plots the unemployment rate against the job vacancy rate across Member States in the third quarters of 2020 and 2022. The fitted line has moved left, thus providing evidence of increased efficiency in European labour markets. Furthermore, compared with the third quarter of 2020, in 2022 the number of countries with very tight labour markets has increased from one (Czechia) to five (Austria, Belgium, Czechia, Germany and the Netherlands). Between 2020 and 2022, the largest reductions in unemployment were registered in Greece and Spain, where unemployment declined by 4.7 and 3.7 percentage points, respectively. However, unemployment levels in the two countries remain the highest in the EU. Overall, in the aftermath of the pandemic, unemployment levels have declined in all Member States while the vacancy rate has increased in 25 out of the 27 Member States.

Figure 5: Average job vacancy rate versus average unemployment rate by Member State – Beveridge points, EU27, Q3 2020 (left panel) and Q3 2022 (right panel)

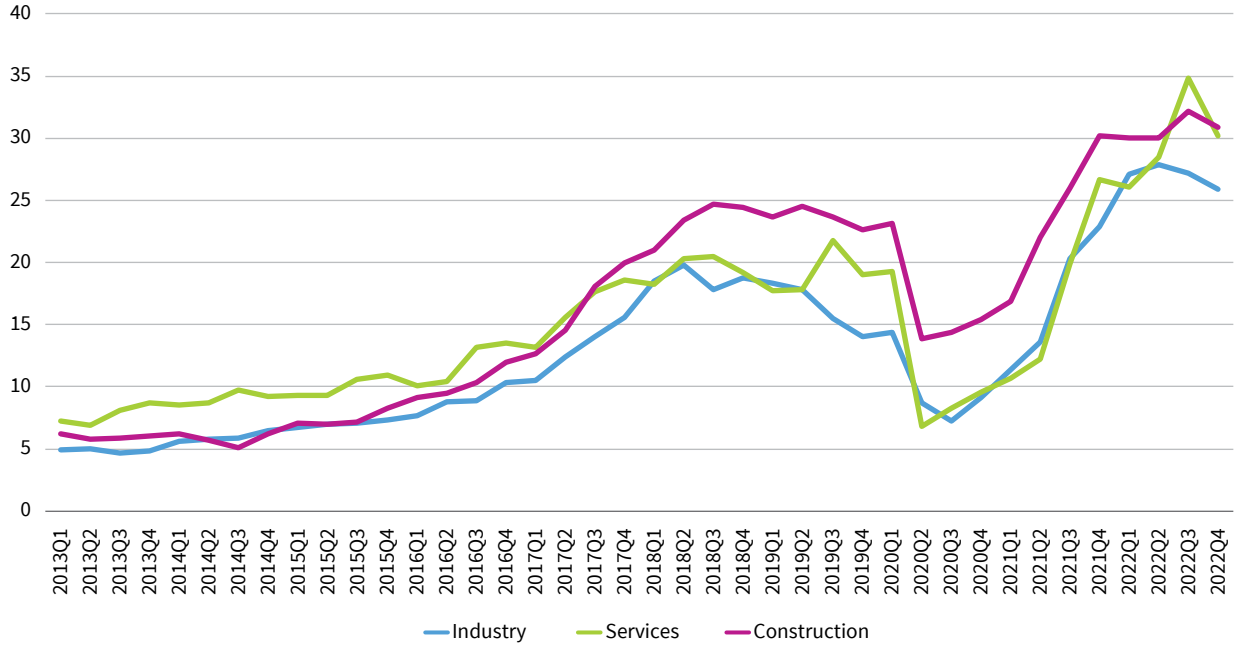


Note: *Data for Denmark and France are not available. The last data available for job vacancies in Portugal are from Q2 2022. The last data available for the unemployment rate in Romania are from Q2 2022.*

Source: *Authors, based on Eurostat, Job vacancy statistics by NACE Rev. 2 activity – quarterly data (from 2001 onwards) [jvs_q_nace2] and Unemployment by sex and age – quarterly data [une_rt_q], seasonally adjusted data*

The surge in labour demand and the increasing recruitment challenges faced by European employers are also captured by business sentiment indicators, which track managers' perceptions of the role of labour as a factor limiting production. Figure 6 shows that, as of the last quarter of 2022, labour shortages reached an all-time high in the three broad sectors of the European economy. The shares of managers reporting that labour was a factor limiting production in the industry, services and construction sectors in the last quarter of 2022 were 26%, 30% and 31% respectively. In industry, the increase was driven by the worsening of shortages in specific subsectors, including producers of machinery and equipment, and persistent high shortages in the electronics, vehicle manufacturing, and rubber and plastics sectors. In the services sector, labour supply remains a major concern, especially for subsectors linked to the digital transition such as architectural and engineering activities, computer programming, or services to buildings and landscape (European Commission, 2022d). Existing evidence suggests that aggravating labour shortages hinder the digital transition and, more broadly, economic growth (OECD, 2022a). In the construction sector, the shortage of labour plus shortages of materials caused by the increase in prices of energy and raw materials were identified as key challenges facing the sector. Labour shortages in the construction sector are particularly high in Finland, Ireland and Luxembourg, where more than 50% of managers reported a deficit of labour in the sector in the last quarter of 2022.

Figure 6: Proportion of companies in the manufacturing, construction and services sectors citing labour shortages as a factor limiting production, EU27, Q1 2013 to Q4 2022 (%)



Source: *Authors, based on EU Business and consumer surveys (BCS) data*

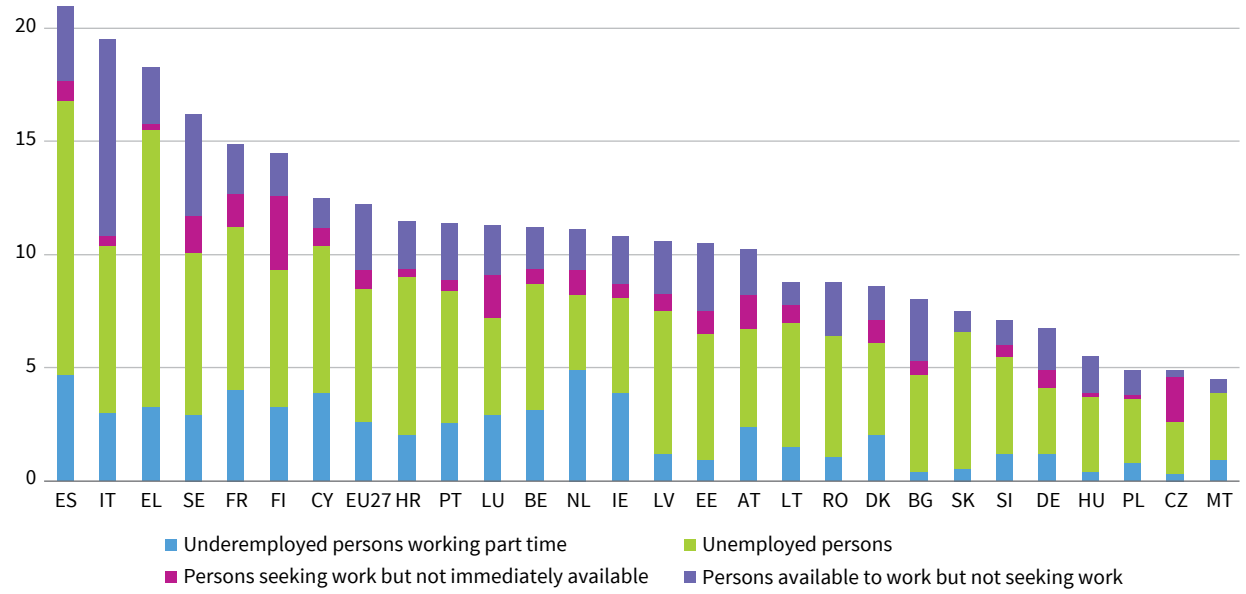
The aggregate indicator for labour market slack or labour underutilisation shows a moderate increase at the start of the pandemic and during the subsequent lockdowns (Figure 7). The level of labour market slack peaked at around 16% in the second quarter of 2020 but did not reach levels seen during or in the aftermath of the global financial crisis. The moderate increase in the level of slack during the pandemic was mainly driven by higher levels of unemployment and an increase in the share of persons available to work but not seeking work. In contrast, the share of underemployed individuals and the share of persons who are seeking work but are not immediately available remained stable during the crisis period and in its aftermath. However, this moderate increase was quickly reversed, and in 2022 labour market slack in the EU reached its lowest level in a decade.

Figure 7: Dynamics of labour market slack and its components, EU27, Q1 2013 to Q3 2022 (%)

Source: *Authors, based on Eurostat data [LFSI_SLA_Q]*

Looking at the distribution of labour market slack by country (Figure 8), it is worth noting that the highest levels of slack exist in countries where labour shortages are well below the European average. This is the case in Greece, Italy and Spain – countries where labour shortages did not increase significantly in the aftermath of the pandemic. Therefore, these labour markets face problems with matching the supply of available labour with existing vacancies rather than high vacancy rates. By comparison, in two countries with very tight labour markets, Belgium and the Netherlands, the levels of labour market slack are similar to the European average, indicating that part of the solution to addressing the growing levels of labour shortages could be in activating underutilised resources in the labour market. In the Netherlands, the level of slack reflects the high share of part-time work in the country and captures the individuals who usually work part time but would prefer to work additional hours. In this sense, the data indicate that a potential strategy for addressing shortages in the economy could be to grant additional hours to underemployed part-time workers.

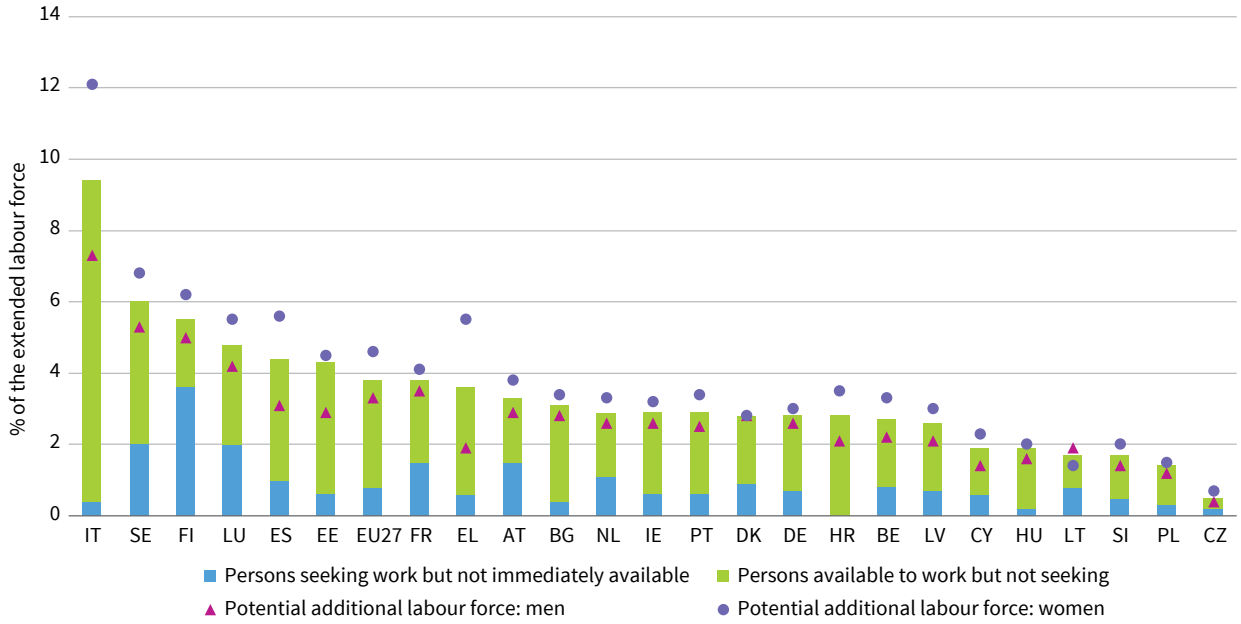
Figure 8: Labour market slack and its components by country, Q2 2022 (%)



Source: *Authors, based on Eurostat data [LFSI_SLA_Q]*

Figure 9 further disaggregates the potential additional labour force by category, country and gender. It shows that women form a larger share of the potential additional labour force, accounting for about 4.6% of the extended labour force. Italy has the largest share of women in the extended labour force who could provide potential additional labour. Large differences across gender lines also exist in Spain and Greece. The figure also shows that, even though the average level of labour market slack declined in 2022, countries could tap into the additional labour force to address some of the existing labour shortages.

Figure 9: Share of potential additional labour force by category, country and gender, Q3 2022 (%)



Source: *Authors, based on Eurostat data [LFSI_SLA_Q]*

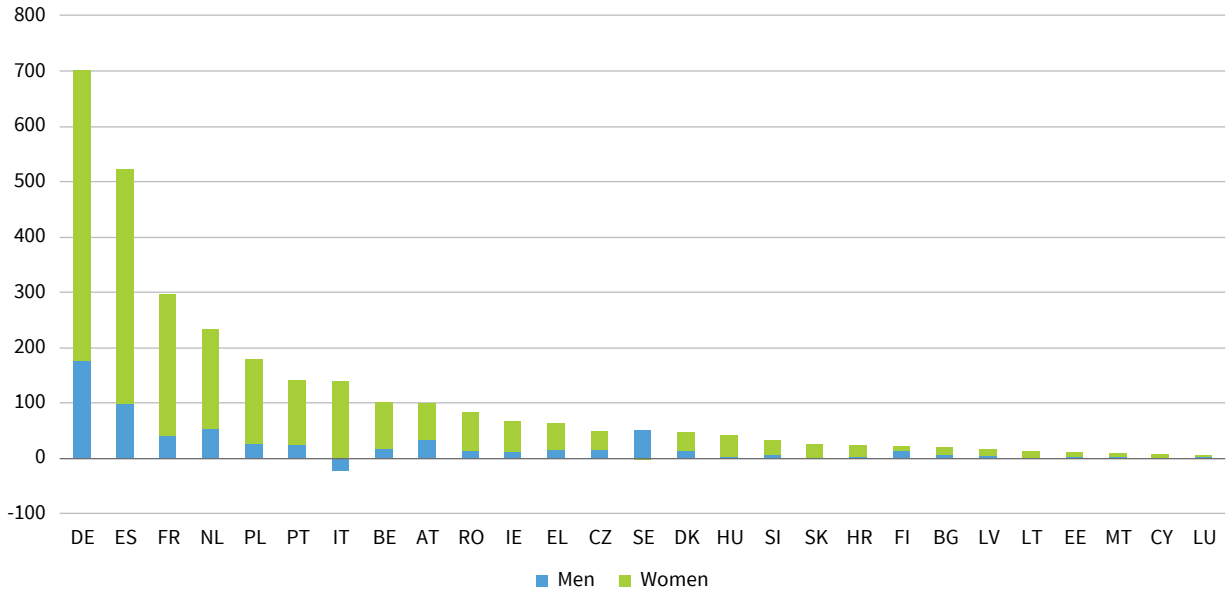
While in principle a tight labour market could contribute to wage increases, this did not materialise during the recovery phase of the pandemic. Indeed, despite growing shortages, growth in real wages remained relatively muted in 2021, when it reached 1.5%. As inflation picked up in 2022, real wages saw a 5.1% decline on a yearly basis (European Commission, 2022d). The decline in real wages disproportionately affects low wage earners, many of whom work in sectors that are also confronted with structural labour shortages, such as construction or long-term care. Low and declining wages are therefore likely to further reduce the supply of labour and augment labour shortages.

Labour shortages in the health and long-term care sectors

Between 2013 and 2022, the healthcare sector in Europe added a net 3 million jobs. The growth in employment in the sector during this period was 16%, double the average growth rate of employment across the whole European economy. The majority of jobs were created in four countries: France, Germany, the Netherlands and Spain, which accounted for 58% of total job creation in the sector. Figure 10 also shows that women are overrepresented in the sector, accounting for 78% of the labour force in the second quarter of 2022. In 14 Member States, women account for more than 80% of the labour force, with the highest share of female labour in the sector being in the three Baltic states, Croatia and Slovakia.

Despite the growth in net employment, current forecasts predict a shortage of labour in the sector in the medium and long term. The shortage of healthcare workforce is a global phenomenon, with a shortfall of around 10 million workers predicted by 2030 (WHO, 2022). The persistence and growth of labour shortages in the sector reflects, on the one hand, structural challenges related to an ageing population and workforce, skills shortages and mismatches, and challenging working conditions and, on the other, the impact of cyclical factors and the COVID-19 pandemic, which put an enormous strain on healthcare workers.

Figure 10: Growth in employment in the health and social care sector by gender, EU27, Q2 2013 to Q2 2022 (thousands)

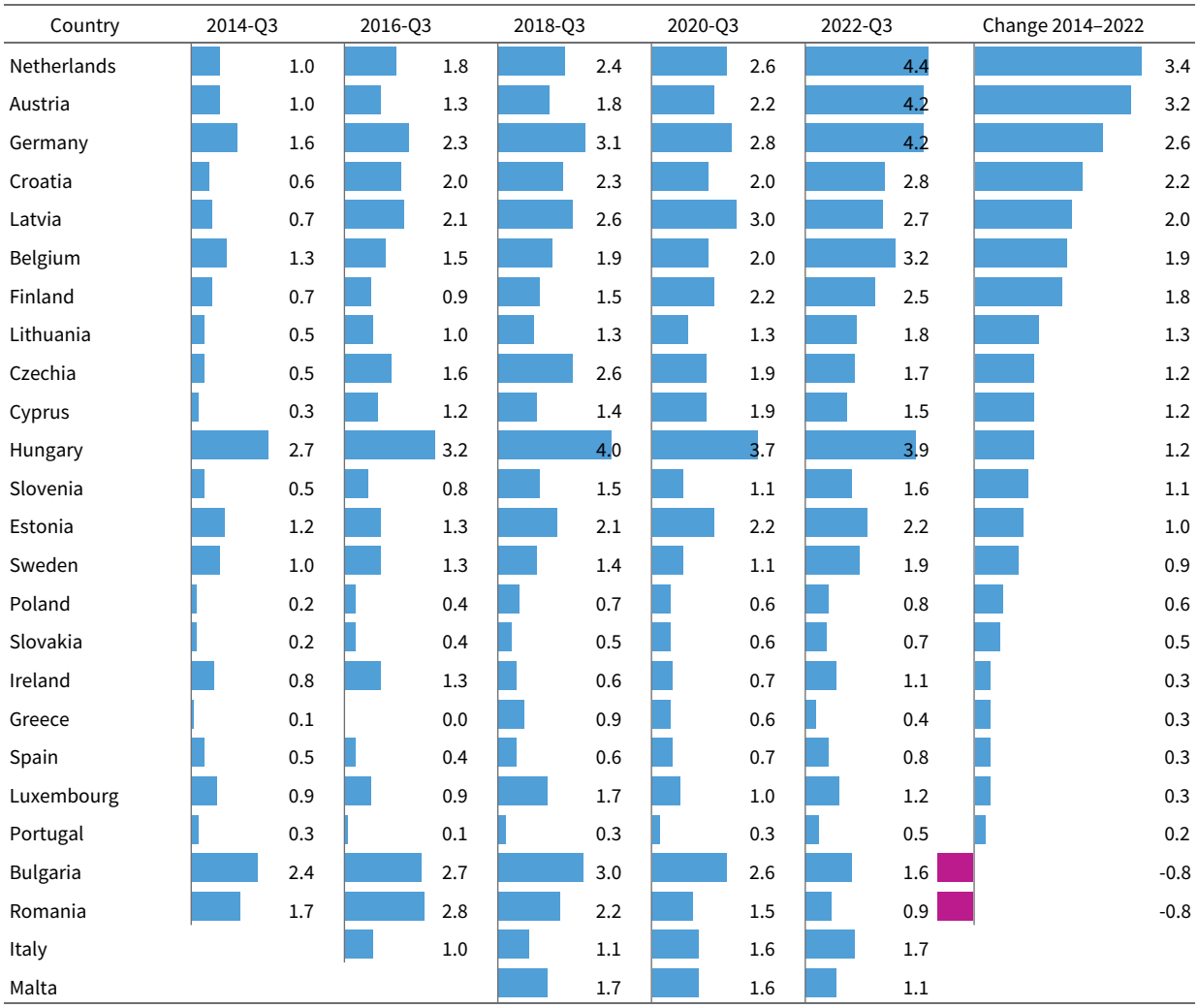


Source: *Authors, based on Eurostat data (LFSA_EGAN2)*

The growth in the scale of labour shortages in the sector is captured by both quantitative and qualitative indicators. Changes in the job vacancy rate in the past 10 years indicate that, except for Bulgaria and Romania, labour shortages increased in all Member States. The largest increases in the rate of vacancies were registered in Austria and the Netherlands, where the vacancy rate has more than tripled since 2014. Despite 700,000 workers joining the sector (see Figure 11), growing labour shortages are also evident in Germany, where the job vacancy rate was above 4% in the third quarter of 2022.

The annual reports of shortage and surplus occupations published by the European Commission (2019b, 2020d) and European Labour Authority (ELA, 2021) also provide evidence that professionals in the healthcare sector, including doctors and associate professional nurses, are in short supply. For example, shortages among healthcare occupations were listed as 'widespread' in Europe in both 2020 and 2021, with nursing professionals being included in the group of occupations with severe shortages in both years (ELA, 2021). The reports also underline the shortage of other professionals in the sector such as general practitioners (GPs). Even though the number of doctors per capita in Europe has increased in the past decade, the share of GPs has declined. The shortage of GPs is linked to a wide array of factors including differences in pay levels between specialist doctors and GPs, the unequal distribution of GPs between urban and rural areas, and difficulties with recruiting candidates with the appropriate skills. The shortage of GPs is particularly acute in rural or underdeveloped areas due to the additional challenges arising from the lack of attractiveness of jobs, the lack of job prospects and poorer working conditions, the lack of health infrastructure, and physicians' preference to live and practise in cities.

Figure 11: Job vacancy rates in human health and social work activities, EU27, Q3 2014 to Q3 2022 (%), and the change in percentage points



Note: *Data for Denmark and France are not available. Values for Italy and Malta are missing.*

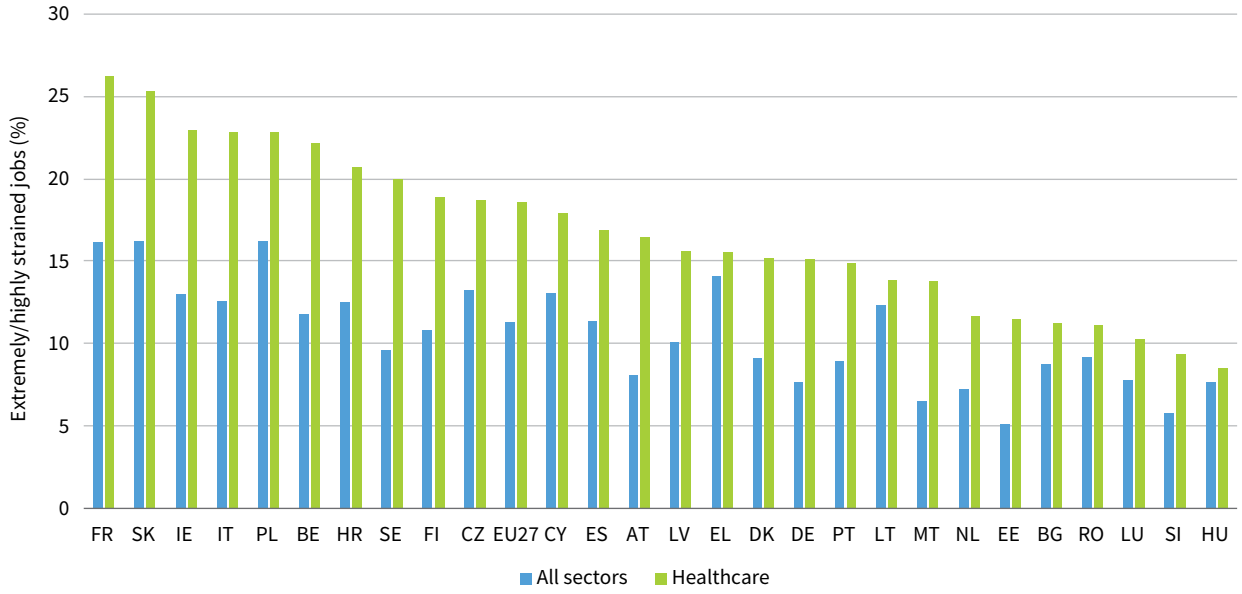
Source: *Authors, based on Eurostat, Job vacancy statistics by NACE Rev. 2 activity – quarterly data (from 2001 onwards) [jvs_q_nace2]; seasonally unadjusted data*

Working conditions are a particularly significant problem for the healthcare sector. These can involve precarious contractual arrangements, long and unsocial hours, shift work patterns, high levels of work intensity, dangerous working environments – including among the highest levels of experiences of verbal abuse and threats, bullying, harassment and violence in the workplace – low pay and limited job prospects. On the one hand, poor working conditions are a driver of shortages, as they deter workers from taking jobs while also contributing to higher turnover rates. They also increase the vulnerability of the health workforce, resulting in high levels of stress, anxiety, burnout or depression. Given the highly segregated labour market in healthcare, poor working conditions are more likely to affect women, especially nurses and workers in the long-term care sector. Labour market segregation is also linked to the gender pay gap in the sector. While the remuneration of doctors – a male-dominated occupation – is substantially higher than the national average in all European countries, nurses' wages are only slightly above or even below average wages. For example, in Finland, France, Latvia and Lithuania, nurses earn less than the national average wage (OECD, 2022b). Cross-national differences in pay levels further compound nurse shortages, as countries with more generous remuneration systems are able to attract labour from countries with lower pay levels. This has prompted substantial increases in the remuneration of nurses between 2010 and 2020, especially in some central and eastern European countries. However, wide east–west differences in average levels of pay for both nurses and doctors remain (OECD, 2022b). At global level, recourse to recruitment from other countries raises concerns about increasing difficulties in retention and recruitment in countries similarly suffering from shortages.

Conversely, labour shortages can also be a driver of poor working conditions, as they contribute to increasing work intensity among workers in affected sectors. Figure 12 uses the European Working Conditions Telephone Survey (EWCTS) 2021 to compute the share of jobs that face high or extreme strain in the healthcare sector and on average for all sectors in the economy. A job is considered to be

'strained' when the number of job demands exceeds the number of job resources. Job demands include an array of indicators for poor job quality including physical risks and demands, social demands, work intensity, dependency, unsocial hours and job insecurity.[2] As Figure 12 illustrates, the quality of jobs in the healthcare sector is much poorer than the national averages in all Member States. In 2021, 19% of health workers in the EU worked in extremely or highly strained jobs compared with 11% across all economic sectors. In four countries, Belgium, France, Italy and Sweden, differences in the share of poor-quality jobs in healthcare and other sectors exceed 10 percentage points.

Figure 12: Share of extremely and highly strained jobs in the healthcare sector by country, EU27, 2021 (%)



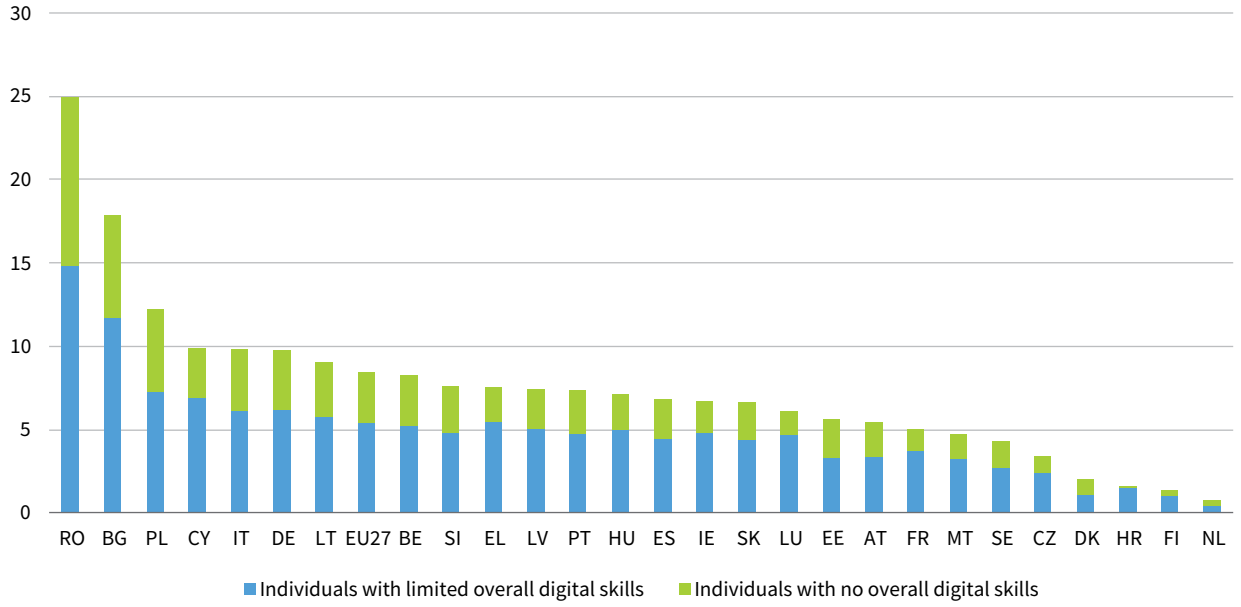
Source: *Authors, based on Eurofound EWCTS 2021 survey*

Labour shortages in ICT and digital skills

Digital skills enable people to participate in the labour market by increasing employability and job security. Digital skills competencies are also associated with a wage premium, with the returns being significant even for individuals with low levels of formal qualifications (OECD, 2016). They also increase well-being and foster innovation and productivity in companies. However, despite the positive associations between the level of digital skills and socio economic outcomes, existing evidence indicates that European economies are lagging in this area (Centeno et al, 2022). The lack of sufficient digital skills in the labour market has roots in both supply- and demand-side factors. On the supply side, the data demonstrate that there are large differences in average levels of digital skills between Member States. The most recent Eurostat ICT survey shows that, in 2021, 8.5% of Europeans had limited or no overall digital skills. The share of individuals with no or limited digital skills was as high as 25% in Romania and less than 1% in the Netherlands (see Figure 13).

2 For further details on the construction of the job quality index, see Eurofound (2022a).

Figure 13: Share of individuals with no or limited overall digital skills, EU27 (%)



Source: *Authors, based on Eurostat European Union 2021 survey on the use of ICT in households and by individuals [isoc_sk_dskl_i21]*

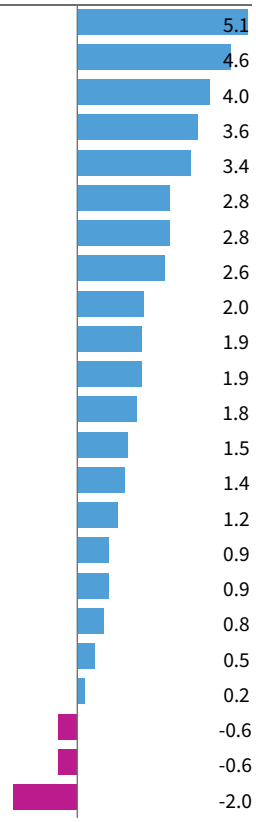
Demand for digital skills is also increasing. Digital technologies such as artificial intelligence (AI), robotic process automation software and advanced robots are increasingly used in workplaces to streamline production processes, automate menial or repetitive tasks, and monitor workflows (Eurofound, 2022c). The pandemic has also contributed to the digital transformation of European workplaces, forcing employers to deploy digital technologies in various workplace processes including day-to-day communication, work organisation, supply chain operations and the increased usage of online and cloud solutions. Importantly, the pandemic has also led to significant increases in telework and in the use of digital tools in the surveillance and monitoring of workers and their performance (Eurofound, 2022d).

In this context, the second European Skills and Jobs Survey from the European Centre for the Development of Vocational Training (Cedefop) found that in 2021 87% of the jobs in the EU required at least basic digital skills (Cedefop, 2021). While 52% of all EU jobs have low skills demands, for 32% skills demands are moderate and for 17% they are high. The survey also confirms that the pandemic has contributed to an increase in the digitalisation of European workplaces, with almost half of adult workers having witnessed novel technologies being introduced at their workplace. Moreover, the education level of around 40% of European workers is not matched with the job requirements: while 28% are overqualified for their jobs, 12% are underqualified. These findings are corroborated by data from Eurofound's 2019 European Company Survey, which show that 77% of European establishments have difficulties in finding candidates with the required skills for available positions. Moreover, 36% of European establishments faced great difficulties in recruiting job-ready candidates in 2019, with the highest shares in Romania (52%) and Bulgaria (50%) and the lowest in Denmark (16%) and Finland (23%) (Eurofound, 2022a).

Skills shortages are particularly acute in sectors that require advanced digital skills, such as the ICT sector. Despite the increase in employment in the sector in recent years, at the current growth rate the EU is still likely to be short of the 20 million experts needed in key areas such as cybersecurity and data analysis in 2030 (European Commission, 2021b). Indeed, job vacancy data show that between 2014 and 2022 the job vacancy rate in the ICT sector increased in all European countries, except for Croatia, Greece and Ireland (see Figure 14 on next page). The increase in the level of vacancies was very high in Belgium (+ 5.1 percentage points), the Netherlands (+ 4.6 percentage points) and Austria (+ 4.0 percentage points) – countries where the level of vacancies was already above the EU average in 2014.

Figure 14: Job vacancy rates in the ICT sector, EU27, Q3 2014 to Q3 2022 (%), and the change in percentage points and as a ratio

Country	2014-Q3	2016-Q3	2018-Q3	2020-Q3	2022-Q3	Change 2014–2022
Belgium	4.0	6.2	6.3	5.9	9.1	5.1
Netherlands	3.6	4.5	5.9	4.5	8.2	4.6
Austria	2.7	2.8	5.3	4.5	6.7	4.0
Czechia	0.8	2.8	4.5	4.4	4.4	3.6
Sweden	2.4	3.8	4.5	2.7	5.8	3.4
Slovenia	1.4	1.9	2.1	2.2	4.2	2.8
Latvia	0.7	1.9	1.7	2.1	3.5	2.8
Denmark	2.5	3.2	3.2	2.5	5.1	2.6
Germany	3.8	3.1	3.7	3.4	5.8	2.0
Hungary	2.6	3.4	3.7	2.1	4.5	1.9
Poland	1.9	2.0	2.3	1.7	3.8	1.9
Luxembourg	2.2	2.3	3.2	1.8	4.0	1.8
Estonia	1.4	3.0	2.6	1.8	2.9	1.5
Cyprus	1.1	1.1	3.1	3.2	2.5	1.4
Lithuania	1.9	2.4	2.3	2.0	3.1	1.2
Spain	0.7	1.1	1.4	0.6	1.6	0.9
Portugal	2.5	1.3	2.3	2.7	3.4	0.9
Bulgaria	0.2	0.4	0.5	0.4	1.0	0.8
Romania	0.9	1.4	1.7	0.9	1.4	0.5
Slovakia	0.4	0.7	0.9	0.4	0.6	0.2
Croatia	1.0	0.8	0.6	0.4	0.4	-0.6
Ireland	2.7	1.5	1.8	1.4	2.1	-0.6
Greece	2.4	0.5	0.7	0.2	0.4	-2.0
Malta			2.9	2.5	5.6	
Finland		2.7	2.6	1.5	4.7	
Italy		1.3	1.6	1.3	3.1	
EU27	2.3	2.6	3.0			

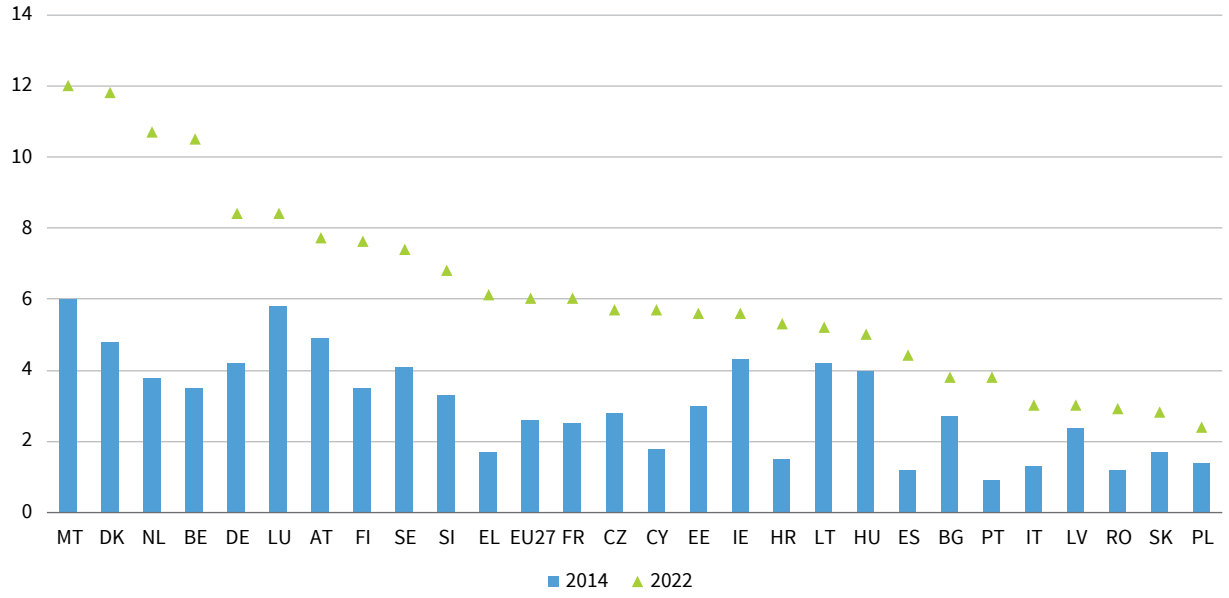


Note: *Data for France are not available. Values for Finland, Italy and Malta are missing.*

Source: *Authors, based on Eurostat, Job vacancy statistics by NACE Rev. 2 activity – quarterly data (from 2001 onwards) [jvs_q_nace2]; seasonally unadjusted data*

Occupations reporting large shortages in 2021 were software developers, systems analysts, application programmers, and web and multimedia developers (ELA, 2021). Furthermore, in 2022, 6% of European enterprises had hard-to-fill vacancies for jobs requiring ICT specialist skills, an increase of 3.4 percentage points since 2014 (see Figure 15). The shares of enterprises with hard-to-fill vacancies for jobs requiring ICT specialist skills were highest in Belgium, Denmark, Malta and the Netherlands, where more than 10% of enterprises had such vacancies.

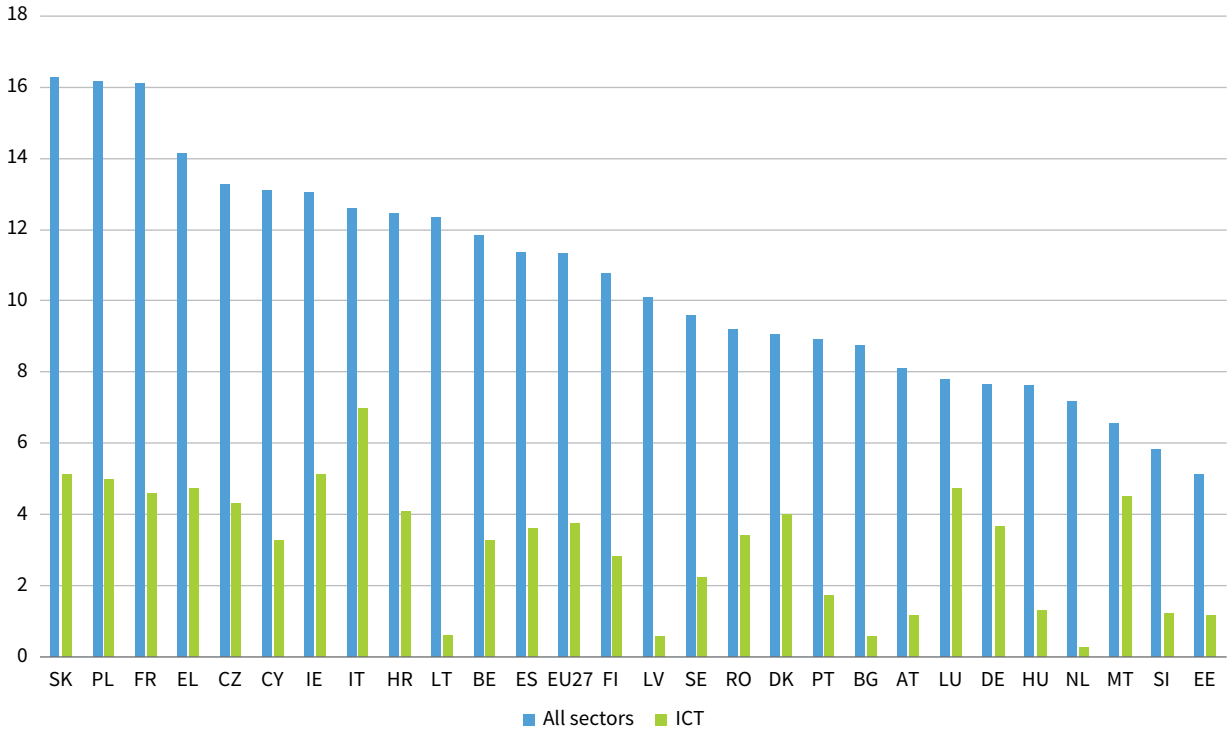
Figure 15: Percentages of enterprises that had hard-to-fill vacancies for jobs requiring ICT specialist skills



Source: *Authors, based on Eurostat, ICT usage in households and by individuals [isoc_ske_itrcrn2]*

In contrast to the healthcare sector, the quality of work does not seem to be a driver of labour shortages in the ICT sector. On average, the job quality in the sector is much higher than national averages, with the share of high-strain jobs ranging between 7% in Italy and 0.3% in the Netherlands (see Figure 16). At the same time, wage levels in the sector are high in comparison with national averages, which acts as a pull factor, drawing employees with information technology (IT) skills from other occupations (European Commission, 2022d).

Figure 16: Share of extremely and highly strained jobs in the ICT sector by country, EU27 (%)



Source: *Authors, based on Eurofound EWCTS 2021 survey*

Labour shortages linked to the green transition

The transition to a green economy is the cornerstone of the European growth model. The policy proposals advanced by the European Commission under the umbrella of the European Green Deal aim to make the EU climate-neutral by setting an intermediary target of reducing net greenhouse gas (GHG) emissions by at least 55% by 2030 and achieving net zero GHG emissions by 2050. This is to be achieved through massive investments that will contribute to cutting GHG emissions across all sectors of the economy (Eurofound, 2023b).

Existing research on the aggregate employment effects of green policies in Europe tends to indicate that changes triggered by the green transition will be of small magnitude. For example, the impact assessment of the Fit for 55 package estimates that the employment effects of the measures will be somewhere between -0.3% and 0.5% by 2030 (Vandeplas et al, 2022). Similarly, estimates from the Eurofound Future of Manufacturing in Europe project expect that a successful transition to a low-carbon economy, as defined by the Paris Climate Agreement, would result in a 1.1% growth in gross domestic product and a 0.5% growth in employment in the EU by 2030 (Eurofound, 2019). However, a recent forecast by Eurofound (2023a) provides more conservative estimates, predicting that the net employment effect of the Fit for 55 package will be positive but smaller, at 0.1%, than in the reference scenario. In contrast, Cedefop (2021) forecasts that meeting the European Green Deal emission target would result in employment growth of 1.2%, or around 2.5 million jobs, by 2030.

While the net employment effects of the green transition are projected to be relatively small, larger impacts are likely to unfold across sectors, occupations and tasks. At sector level, the green transition is expected to lead to a structural shift in employment away from carbon-intensive sectors and to increase the demand for jobs in sectors contributing to the greening of the economy. However, the extent to which job destruction in carbon-intensive sectors will address employment needs in other sectors depends on the skills composition of workers in these sectors, the effectiveness of policy support to ensure smooth job transitions and the highly localised nature of employment in the carbon-intensive sectors, which is likely to have an impact on the mobility of workers. The employment forecasts described above also find that job creation will be unequal across the economy, with employment in the sectors most linked to the green transition, such as construction, being expected to register the largest increases. Other sectors that are predicted to grow in terms of employment are the primary sector and utilities, as well as the manufacturing of low-carbon goods and technologies such as wind turbines or electric appliances (Cedefop, 2021; Eurofound, 2023b).

Importantly, employment predictions highlight the increased demand for labour in sectors that are already facing structural labour shortages (see Figure 6). The construction sector is a case in point. The scenario put forward by Cedefop (2021) highlights that by 2030 the sector would need an additional 3 million to 4 million workers in order to meet the targets set by the transition to net zero emissions, which involve the improvement of the energy efficiency of buildings through renovation and retrofitting. The European Commission also expects that an additional 160,000 green jobs could be created in the EU construction sector alone as a result of the renovation wave that is part of the European Green Deal (European Commission, 2019a). However, despite the potential for job creation, as of 2023 the sector is facing significant labour shortages due to a range of factors, such as workforce ageing, poor working conditions and a lack of workers with specific skills that respond to the needs generated by the green transition, such as specialists in deep building renovation, installers of advanced technological solutions, or building information modelling managers (European Commission, 2020e). In this respect, if left unaddressed, current labour shortages in the construction sector could have a negative impact on the achievement of green targets.

Labour demand is also set to increase for green jobs and green skills. Although different definitions of ‘green jobs’ or ‘green skills’ are currently used in academic and policy literature (Eurofound, 2023b), the main difficulty lies in separating green jobs from other jobs and defining the associated green skills. Often such a distinction relies on either an output or a process perspective. In terms of the former, green jobs are found in companies and sectors that produce goods and services that are either environmental in the strictest sense or relatively environmentally friendly (Eurofound, forthcoming b). From a process perspective, the definition of green jobs goes beyond this and covers employment that seeks to improve the environmental impact of companies that do not produce environmental goods in either sense.

The absence of agreed definitions contributes to a lack of coordinated data collection at national and transnational levels. Organisation for Economic Co-operation and Development (OECD) and Eurostat indicators focus on employment in ‘environmental industries’, which produce goods and services that reduce environmental risks, emissions and consumption of resources (World Bank, 2012). This approach leads to falsely labelling some jobs as green just because they are in green sectors while failing to recognise others as relevant because they are in non-green sectors (Consoli et al, 2016; Vona, 2021).

The US Bureau of Labor Statistics extends the distinction of a process perspective and distinguishes ‘jobs in businesses that produce goods and provide services that benefit the environment or conserve natural resources’ from ‘jobs in which workers’ duties involve making their establishment’s production processes more environmentally friendly or use fewer natural resources’ (Bruvoll et al, 2012). Using data from the US Green Economy programme of the Occupational Information Network (O*NET), Vona et al (2019) propose an alternative accounting method based on the identification of groups of work tasks and on an occupation-specific index of ‘greenness’, which is based on the share of green tasks in each job. However, the applicability of such an approach depends on the existence of detailed data on work tasks

by occupation, which are unfortunately still not widely available for Europe.

Dierdorff et al (2009) use O*NET data to distinguish between four types of occupations as shown in Table 3.

Table 3: Classification of greening occupations

Label	Description
No-greening	Occupations with limited or no impact of greening.
New and emergent	New and emerging occupations that do not exist in ISCO-08* and are classified in one of the old codes, despite having new characteristics; these might require separate classification.
Enhanced skills	Existing occupations that will potentially require changes in tasks, skills and knowledge as a result of the transition to a carbon-neutral economy, although the essential purpose of the occupation remains unchanged.
Increased demand	Existing occupations that will not require changes in tasks, skills and knowledge but will potentially see increased demand due to the transition to a carbon-neutral economy.

Note: **International Standard Classification of Occupations-08.*

Source: *Eurofound, 2022a*

According to data from EWCTS 2021, nearly 65% of workers in the EU27 were employed in occupations that will experience only a small impact or none at all from the green transition. Close to 10% of workers are in new and emergent occupations, while close to 15% are in sectors either requiring enhanced skills or likely to witness growing demand (Eurofound, 2022a).

Nonetheless, despite growing debate on the impact of climate change and climate change policy on employment and the increasing need for the delivery of green skills, the lack of skilled labour remains a significant barrier to the low-carbon transition (ILO, 2016; OECD, 2017; Relly et al, 2022).

Data published by LinkedIn (2022) show that, while job postings requiring green skills grew by 8% annually over the last five years, the share of green talent grew by 6% annually during the same period. The lack of green skills is particularly acute in medium- and high-skilled occupations, which are likely to necessitate more significant changes in terms of technical skills and knowledge (ILO, 2019).

Role of sector and occupation in driving the policy approach

Given the prevalence of structural labour shortages in a number of sectors and occupations, and the increasing emergence of new skills shortages linked to the twin green and digital transition outlined above, policymakers are keen to find effective solutions to address these issues in order to prevent negative economic and societal impacts from emerging (Eurofound, 2021). The purpose of the next three chapters is to summarise the findings of the 40 evaluated policies that primarily seek to address labour shortages in the health, care and ICT sectors as well as tackling skills shortages in occupations affected by the green and digital transition. The findings are presented from this sectoral and occupational perspective not least to highlight that the nature of policy approaches tends to be informed by the drivers of labour shortages, meaning that in terms of the balance of the approaches adopted they mainly seek to address these underlying challenges.

As outlined above, in the health and long-term care sectors, pay and working conditions are important reasons for shortages, whereas in the ICT sector, where in general pay and conditions tend to be better, the overall lack of appropriately skilled labour is a more significant factor. In the context of the twin green and digital transition, the need to ensure that initial and ongoing training are available and keep pace with changing labour market requirements tends to be at the forefront of policymakers' concerns. However, beyond these general cross-cutting drivers, specific national and regional contexts also inform the drivers of shortage, choice of policies, and the likely success factors for or barriers to effective policy design and implementation.

As well as presenting the policy approaches adopted in the targeted sector, each of the three chapters explores what works for which workers and in which policy context in terms of addressing labour shortages. The final section of each chapter briefly addresses the question of the extent to which current practices of policy evaluation are fit for purpose, to help policy actors learn from experience and see what might need to be improved if they are to contribute to truly evidence-based policymaking.

2 Tackling labour shortages in the health and care sectors

As indicated earlier, the health and long-term care sectors are among the sectors experiencing the most significant structural labour shortages. These shortages were aggravated during the COVID-19 health emergency and are set to continue worsening in the absence of policy intervention, as health and long-term care needs increase with an ageing population. The desire to move more care into the community is met with challenges from a workforce perspective, as national data show particular gaps among skilled workers in long-term care (Eurofound, 2020). An additional challenge for some segments of the healthcare sector is the ageing profile of the workforce and the long periods of training and experience required to replace current employees. A Eurofound report on social dialogue and collective bargaining in the hospital sector during the COVID-19 pandemic throws light on the pressures faced by the workforce, and the push for greater financial recognition and improved working conditions, particularly in the context of austerity and underinvestment in the sector in a number of EU countries following the 2007–2013 economic crisis (Eurofound, 2022e).

Eleven of the 40 policy measures assessed for this study were either entirely aimed at addressing or primarily used to address labour shortages in these sectors. Seven initiatives were implemented in countries featuring some of the highest vacancy rates in the human health and social work activities sector in the EU (namely Austria, Germany, the Netherlands and Sweden, based on Eurostat vacancy rate data for the third quarter of 2022).[3] The remaining four measures were introduced in Bulgaria, Latvia, Romania and Spain. Except for Latvia, these are countries where the vacancy rates in the sector are higher than the national average for all sectors.

As discussed above, drivers of shortages in the health and long-term care sectors are strongly linked to challenging working conditions and comparatively low wages in some subsectors and occupations. Wage levels and working conditions have a particular role to play in shortages among doctors and nurses in some central and eastern European countries, influencing migration patterns from eastern to western and northern Europe. Given these drivers, it is not surprising that nearly half of the evaluated policy measures covered by this study seek to attract labour by addressing wage levels and working conditions in the sector. Two further measures aim to tap underutilised potential by addressing the recognition of qualifications obtained abroad, especially by migrants and refugees from non-EU countries. The retention of doctors suffering from burnout, mental health problems and associated issues (as well as prevention of such issues) is the object of another measure, while the significance of forward workforce planning in a sector requiring long periods of training for many occupations is at the core of another approach seeking to address and prevent future shortages. Enhancing the use of existing labour through ongoing training plays a part in some of the holistic measures aiming to make careers in the health and care sector more attractive and is of particular relevance to professions in the ancillary and long-term care sectors, which are affected by particularly severe shortages in a number of countries and where providers can be small and medium-sized enterprises (SMEs), which are less able to plan and deliver ongoing training.

As well as tackling different drivers of shortage, the measures also address varying target groups and must be understood against key contextual factors and the broader policy environment within which they operate. Table 4 provides an overview of the assessed measures tackling shortages in the health and long-term care sectors, with subsequent sections providing more information and contextual detail on each policy based on the category of measure and therefore the drivers of shortages being addressed.

3 Vacancy rates in this sector are below the national average for all sectors in these countries.

Table 4: Overview of policy measures targeting labour shortages in the health and long-term care sectors

Country	Title of measure	Main goals pursued and measures taken	Supporting and hindering factors
Attracting labour			
Bulgaria	Adverse working conditions payment for GPs	Enhance the attractiveness of specific regions/ geographical areas (remote, poor infrastructure, fragmentation of towns/villages served, demographic profile of the population served) for GPs through monthly additional payments for a predetermined period of time.	**Supporting:** Possible role of adverse working conditions payment in supporting GPs to locate or remain in more remote areas. **Hindering:** Overall lack of financial support for specialisation; more attractive pay and working conditions in other countries; lack of reliable data to assess eligibility of funding; slow updating of rankings when circumstances change.
Germany	KAP	Increase the attractiveness and public appreciation of the care sector through a comprehensive approach to addressing training and ongoing qualifications, working conditions and remuneration, care planning and new approaches to care, and attracting skilled workforce from abroad.	**Supporting:** Holistic approach of the measure and wide range of participating stakeholders; embedding of the measure in existing care structures and wider strategic developments. **Hindering:** Pandemic affected ability to deliver projected additional training.
Latvia	Support to attract medical practitioners outside Riga	Improve the availability of medical and support staff providing services in specialisms facing shortage outside the capital region by enhancing the attractiveness of working in these regions through a one-time incentive payment to the practitioner and family members to cover cost of living. Move has to be for at least five years. Incentive payment is five months' salary in line with lowest payment for the level of qualification and an additional payment for each family member. Aimed at attracting 1,422 additional medical personnel to work outside Riga.	**Supporting:** Financial incentive combined with support from the municipality (for instance, with housing, in some cases even contributing to rent and utility costs); good cooperation with regional hospitals. **Hindering:** High level of bureaucracy attached to relevant national and EU funding; poor education and other infrastructure services in the regions contribute to lack of attractiveness (including for family members).
Netherlands	Buurtzorg Model of Care	Offer a different model of long-term care provision based on person-centred relationships, self-managing teams and reduced bureaucracy, preventing exit from the labour market and improving quality of care.	**Supporting:** Nurse- and client-centric approach with self-organised neighbourhood teams; reduced bureaucracy. **Hindering:** Perceptions based on usual model of management thinking.
Romania	2018 wage increase	In March 2018, increase gross basic wages for doctors and nurses to the levels set for 2022. During 2018, the basic net wage of primary care doctors increased by 130%. For nurses, the increase was 63%.	**Supporting:** Legislative stability linked to the 2018 wage increase; increase in number of available residency places also contributing to fewer younger doctors leaving. **Hindering:** Relatively limited opportunities for career advancement; recruitment to regions outside the capital and major cities remaining low due to poor infrastructure in healthcare and beyond.
Activation of underutilised labour			
Germany	IQ	Enable migrants already living in Germany to have qualifications gained abroad recognised as equivalent to a related German qualification to enable commensurate employment. Provision of additional modular training to obtain additional qualifications. Advice to employers who want to benefit from the 2020 Skilled Workers Immigration Act. Cultural sensitivity training for labour market actors.	**Supporting:** Development of a strong infrastructure and networks to support the recognition of qualifications and provision of relevant training, based on agreed quality standards; provision of individualised advice and support. **Hindering:** Fragmentation of training and recognition of qualifications at regional level; need to move services online during the pandemic and restrictions on mobility; time-consuming process of recognition and associated cost; shortage of specialised language training; varying levels of financial support for additional training at regional level.

Country	Title of measure	Main goals pursued and measures taken	Supporting and hindering factors
Sweden	Fast Track	New model to foster the rapid integration of migrants into the labour market (particularly those migrants with academic backgrounds), reducing existing labour shortages in several occupations (for instance, medical doctors). Fast track accreditation and modular training to address gaps in skills for accreditation. Delivery of Swedish language training and training on the Swedish health system.	**Supporting:** Collaboration between social partners in reassessing the requirements for validation and standardising labour market requirements for each sector. **Hindering:** Dissemination of information about the programme difficult for migrants not in touch with PES; underemployment a continuing issue among nurses; out of pocket payment needed from beneficiaries for accreditation of some qualifications.
		Enhancing the use of existing labour	
Austria	FKS	Provide support for training in shortage occupations lasting between three months and three years to unemployed people, self-employed people who have registered their business as dormant and workers wishing to pursue ongoing training. Allowance paid to cover cost of living expenses during training (health, accident and pension insurance are also covered).	**Supporting:** Capacity of PES to provide financial support at the scale required, up to three years of training; availability of good-quality training providers and successful dual training system. **Hindering:** Limited access to the measure for older workers; decreasing share of female beneficiaries.
Germany	WeGebAU	Support ongoing training opportunities offered by SMEs to people traditionally underrepresented in further training to obtain a vocational qualification (people with a low level of skills/qualifications and employed workers over the age of 45). Reimbursement of training costs to the employee (direct programme costs and an allowance for expenses incurred as a result of participating in the training, such as childcare or transport); wage subsidies (co-funding) for the employers.	**Supporting:** Raising awareness of the importance of lifelong learning, particularly for groups generally less likely to access it; wage subsidy for SMEs to make the programme more attractive; involvement of social partners to support wider dissemination. **Hindering:** Relatively complex application process with some perceived stigma about receiving funding from PES.
Netherlands	Health Workforce Planning	Identify and forecast future shortages or potential oversupply in medical/healthcare personnel with a 5- to 15-year horizon, to better anticipate policy solutions for health workforce mismatches. Model contains data for 79 occupations and related education programmes in the healthcare sector. Expected to inform intake into relevant educational programmes.	**Supporting:** Good data available and model proven to be robust; government usually follows advice regarding link to training places. **Hindering:** No impact on other factors that affect the attractiveness of different training pathways and professions; impact of pandemic more challenging to predict.
Spain	PAIME	Prevention of medical errors by doctors suffering from burnout; prevention of early labour market exit. Confidential rehabilitation services for doctors suffering from mental health and/or addiction problems to reintegrate them into the labour market. Delivery of inpatient and outpatient medical and social support, and legal services. Since 2018 also preventative action with information on self-care for medical students and medical residents in training.	**Supporting:** Design and delivery of measure by specialist medical associations in confidence; financing on the basis of solidarity between doctors; establishment of networks of collaborating professionals to assist doctors undergoing treatment/support. **Hindering:** Ongoing need to overcome prejudice; financing model continuing to limit resources.

Note: *PES, public employment services.*

Source: *Authors, based on case studies*

Policy measures to attract labour into the health and care sector

Four of the five policy measures under review which aimed to attract labour into the health and long-term care sectors specifically addressed the issue of wages. One of these targeted wage increases for doctors and nurses across the board, while two measures offered financial incentives for specific healthcare personnel to relocate from city and urban regions to smaller towns and rural areas to address specific geographical shortages. A holistic approach aimed at addressing significant labour shortages in geriatric inpatient and community-based care combines wage increases with other measures to boost the attractiveness of the care sector. The final measure in this category emphasises improved working conditions and greater staff autonomy to support recruitment and retention but mainly focuses on providing more efficient care and to a higher standard. Lessons from these measures demonstrate that, while wages have an important role to play in tackling labour shortages in the sector, improved working conditions, autonomy, good career opportunities and the quality of the surrounding infrastructure also play critical roles and enhancing wages is often insufficient to increase the attractiveness of the sector.

Increase in financial compensation

The Romanian **2018 wage increase** significantly raised the wages of doctors (and to a lesser extent nurses). Among other things, this measure sought to address the high share of doctors leaving the country to practise abroad, with low wages being cited in surveys as the main reason behind the mobility. Given the low starting point of wages and the high outflow of medical personnel from some central and eastern European countries following EU accession, other countries such as Hungary and Slovakia have implemented similar measures.

Romania: Wage increases for healthcare workers

The wage increases for doctors and nurses in Romania were based on the Unique Pay Law for Public Sector Employees in Romania (Law No 153/2017) and was implemented by the Social Democratic Party, which was in government at the time, to help address significant pay disparities in the public sector. In relation to doctors in particular, it was also designed to address labour shortages that persisted despite the high number of students graduating from medical school on an annual basis, which in fact exceed the country's requirements. A key factor behind the shortages of doctors lies in the high rate of outward migration. A 2017 survey among public healthcare personnel indicated that 69% of doctors intended to work abroad and 26% had taken practical steps to leave. Low wages were cited among the main reasons for such decisions, alongside high workload, and poor equipment and infrastructure in domestic hospitals (CMR, 2008; WHO Regional Office for Europe et al, 2011; Ciobanu et al, 2017). Although emigration was a long standing trend among healthcare personnel, this accelerated with EU accession and the impact of austerity measures following the global financial crisis of 2007–2008. Between 2007 and 2017, 14,000 doctors and 21,000 nurses had their medical qualifications recognised for the purposes of permanent establishment in the European Free Trade Association countries (see Figure 17). Emigration among medical doctors posed particular problems in general medicine, emergency care, surgery and cardiology (Apostu and Vasile, 2020).

As a result of the law, the basic net wage of a primary care doctor increased by 131% in 2018. For nurses, the wage increase amounted to 65% (meaning that the proportion of the basic net wage of a nurse with higher education to that of a primary doctor declined from 47% prior to March 2018 to 33% following the implementation of the law).

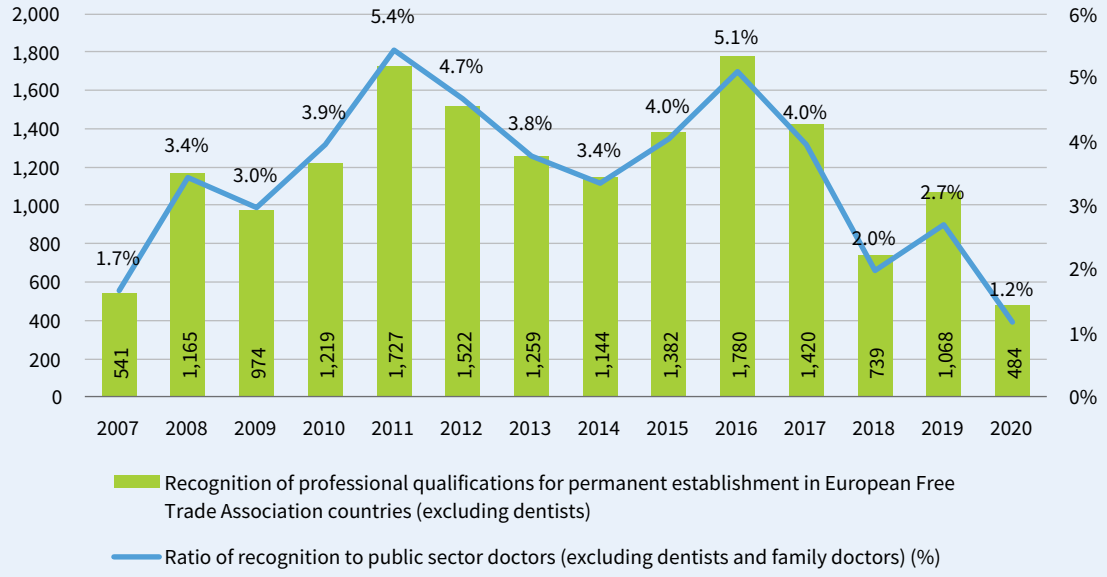
Data on the recognition of professional qualifications for working abroad show that the wage increases appear to have a visible impact, with the number of such recognitions dropping by almost half between 2017 and 2018.

A study undertaken by the healthcare trade union Solidaritatea Sanitară (Lungu and Andoniu, 2018) after the adoption of Law No 153/2017 showed that wages were no longer identified by doctors as the main reason for seeking employment abroad and were now in fact one of the main reasons for staying. While 24% of the doctors who took part in the survey were still intent on migrating for work, the main reasons were the working conditions, opportunities for professional advancement and the overall state of Romanian society. For nurses still intending to leave the country, on the other hand, the main reason for migrating remained the low wages in Romania.

The number of doctors in the public sector increased by 3.4% in 2018, followed by a 6.5% increase in 2019. While the number of doctors increased in the years preceding Law No 153/2017, this happened at much lower rates (2.1% in 2016, 3.1% in 2017) and in a context of increasing vacancy rates. Following the implementation of the law, vacancies dropped throughout the public sector, including in healthcare.

Another factor contributing to the retention of younger doctors in particular was the increase in the number of residency places made available in Romanian hospitals, especially in 2018 and 2019.

Figure 17: Recognition of professional qualifications for working abroad



Source: *European Commission's Regulated Professions Database and INS (National Institute of Statistics Romania)*

Source: *Authors based on case studies*

Despite the apparent success of the 2018 wage increase in retaining medical doctors in Romania, evidence shows that the measure proved insufficient to encourage doctors to work in smaller towns and rural areas, partly as a result of poorer healthcare infrastructure and less attractive living and working conditions, with the latter also continuing to feature among the reasons for an expressed desire to work abroad.

Two further measures from eastern European countries focused on this issue, by offering financial incentives to specific groups of medical personnel to relocate from the capital city and large urban areas: the Bulgarian **Adverse working conditions payment for GPs** and the Latvian **Support to attract medical practitioners outside Riga**. In these countries, labour shortages among medical professionals have been a source of pressure in the national health systems at least for the past decade. In Bulgaria, 73% of hospital managers indicate that there is a shortage of physicians, while 90% say that there is a shortage of nurses (News.bg, 2022). These shortages problems are aggravated by – and contribute further to – poor working conditions in the sector. In Bulgaria, in 2021 alone over 400 GPs (10% of the GP labour force) stopped practising for various reasons, with workplace stress being a significant factor (BGONAIR.bg, 2022). Recruitment and retention challenges are accentuated by a lack of career development for GPs, high workloads (for instance, a GP practice in Bulgaria can cover 20–30 villages, leading to higher work intensity and more on-call time), the older demographic profile of the population being served, with associated complex health issues, poorer healthcare infrastructure and lower salary levels than in large cities. These factors contribute to high levels of brain drain, further aggravating the recruitment and retention issues. In the case of Bulgaria, approximately 70% of new physicians graduating from university leave the country, due to the economic attractiveness of practising abroad and the high price that future physicians need to pay in Bulgaria to obtain specialist training (Investor.bg, 2022). This situation is aggravated by the demographic ageing of the workforce within the sector; the average age of the 4,200 GPs in Bulgaria is 58 years.

The Bulgarian measure provides a monthly top-up payment, with a value based on a calculation of factors considered to constitute extremely adverse working conditions, and focuses on GPs, whereas the Latvian initiative, co-financed from the European Social Fund (ESF), offers a one-off payment to medical staff reported as being in short supply in different regions (with additional payments made to relocating family members). Workers are required to relocate for a minimum of five years to retain this payment.

Both interventions are considered to have had some degree of success in achieving their goals (Boichev and Guliani, 2016; Likumi.lv, 2017). In Bulgaria, between 2016 and 2021, around 860 practices per annum received support through the measure, with the average monthly additional adverse working conditions payment amounting to €240. An evaluation showed a positive and statistically significant effect on the ratio of GPs to population in rural areas targeted by this intervention. Overall, the higher the amount of compensation (calculated on the basis of the number of adverse factors present), the more likely it is that a practitioner can be attracted to a specific region. However, no evidence is available on the longer-term impact of the measure, and the evaluation considers that there is an optimal number of towns and villages that can be covered by one GP, after

which the cost of providing services would increase at a faster rate than the compensation provided.

Only monitoring data are available on the impact of the Latvian measure. They show that the programme was effective in encouraging the relocation of 1,151 medical practitioners to rural areas between 2019 and 2021 (including to some of the least developed regions in Latvia). It also helped to secure the relocation of 184 emergency medical personnel; however, this was only about half the targeted number.

A number of contextual and broader policy-related factors are considered to have contributed to achieving these results. In the case of the adverse working conditions payment for GPs, the measure complements other existing policy interventions as part of the broader framework of mixed-model payments to GPs in Bulgaria, consisting of the fee-for-service and per capita payment components currently in operation.

In the case of the Latvian measure, active stakeholder involvement in its design (municipalities, non-governmental organisations (NGOs) and medical associations, among others) is considered to have been beneficial, taking into account the local contexts and the specific problems associated with those remote regions. Regional hospitals actively shared information about their human resource needs as well as employment and career opportunities, while municipalities created valuable synergies and improved the results of the project by providing monetary and non-monetary support (for instance, to find and finance accommodation for doctors). Furthermore, a number of innovations implemented during the life of the measure are considered to have been helpful. For instance, the Latvian Ministry of Health rapidly developed the necessary e-tools to apply for the measure, which streamlined the process.

However, a number of barriers preventing the measures from having a greater impact were also identified. In both countries, these included recurrent issues related to the difficulties and costs associated with obtaining greater professional specialisation, which can motivate doctors to obtain work experience abroad. In relation to the Bulgarian measure, there were difficulties in accessing data to regularly update the database of criteria feeding into the calculation of the level of adverse working conditions payments. In Latvia, the bureaucratic challenges associated with the relevant European and national funding streams were emphasised. Although additional payments were available in cases of family members moving with the medical professionals, this was sometimes considered to be insufficient to make up for the lack of good infrastructure – including, for example, in relation to the education of children – in the more remote regions.

Focus on working conditions and holistic approaches

In the German **KAP**, increasing wages in the geriatric nursing and long-term care sector is one of a set of holistic measures seeking to enhance the attractiveness of the sector. KAP was developed against the backdrop of significant labour shortages, with German public employment services (PES) data showing that for every 100 vacancies there are 26 nursing professionals in geriatric care and 60 in paediatric care registered as looking for work. Despite some variations between regions, these occupations have shortages across the country. The average time taken to fill a vacancy in care for sick or elderly people was 195 days in 2021 (Bundesagentur für Arbeit, 2021). Seyda et al (2021) found that the number of vacancies in geriatric, long-term and general healthcare had increased by 43%, from 40,000 in 2011 to 57,000 in 2021, with key gaps present for skilled and specialist staff. The Federal Ministry of Labour estimates that demand for 150,000 staff in 2020–2025 will be met with a supply of just 120,000 workers (BMAS, 2021). These data contributed to the design of the KAP measure in 2018.

Germany: Encouraging staff to enter and stay in care professions

Concerted Action on Care (*Konzertierte Aktion Pflege*, KAP) is a measure implemented jointly between different national ministries and other stakeholders in 2019–2023. Its aims were to increase the intake of trainees in the care professions and foster the retention of staff by improving wages and working conditions, including by ensuring sustainable and more uniform staffing levels in care settings. To increase the effectiveness and efficiency of care provision, it also includes the implementation of innovative care approaches, including using digital tools. Each element of the measure is associated with specific goals overseen by individual working groups bringing together relevant stakeholders (Table 5).

Table 5: Summary of working group activities and goals

Working group	Goals and intended outcomes
1. Training and qualification	Develop new care training framework and provide dual training placements. Increase number of trainees by 10% in 2023 (compared with 2019). Attract more men and migrants in particular, and prevent early exit. Support transferability between training pathways and support good training infrastructure. Enhance the image of relevant occupations and promote retraining in care.
2. Personnel management, occupational safety and health	Focus on recruitment and retention through improvements in working conditions. Improve personnel planning; reduce involuntary part-time and fixed-term employment; support return to the caring profession; improve staffing and staff assessment.
3. Innovative care approaches and digitalisation	Ensure effective use of digitalisation potential in care including tele-nursing, e-counselling and enhanced neighbourhood networking.
4. Care staff from abroad	Promote targeted recruitment and training (inside and outside the EU); improve recognition of foreign qualifications; support language training; collaborate specifically on training with countries such as Brazil, Mexico and the Philippines.
5. Remuneration	Ensure enhanced remuneration especially in the care of the elderly while respecting the autonomy of collective bargaining.

Source: *Authors, based on Bundesregierung (2021)*

Implementation of the measure is still under way, but annual monitoring data point to an increase in the number of entrants into care training of 8% in 2019–2020 compared with 2018–2019, and 2% in 2020-2021. The increase in 2020 is considered a success given the challenges posed to delivering training during the pandemic. However, the pandemic is seen to have contributed to a 33% year on year drop in participants in PES-funded training for geriatric care specialist nurses in 2020 compared with the previous year.

Between 2017 and 2020, 17,300 additional skilled worker posts and 40,000 auxiliary posts were created in geriatric care, and wages in this sector increased by 15% on average. A new law in 2021 made further provision for the recruitment of 7,300 additional care specialists and 20,000 additional care assistants in care facilities to improve staff to patient ratios and ease pressure on existing staff to enhance retention. Additional funding has also been made available to organisations for work–life balance measures (including facilities for childcare and elderly care for staff) (Bundesregierung, 2021).

In terms of recruitment from abroad, a specific agency has been established to compile country reports on foreign professional qualifications and the differences from training in Germany, to allow for more rapid recognition and additional training offers. Specific training centres, including language training, have been established in collaboration with a number of countries, and additional support is being offered to employers seeking to use the provisions of the Skilled Workers Immigration Act to recruit staff.

Source: *Authors based on case studies*

The final measure in the category of policies aimed at attracting labour is the **Buurtzorg Model of Care**, which seeks to make work in the community-based long-term care sector more attractive by giving nurses more say over the scheduling and delivery of their tasks. In 2022, the Netherlands was considered to face a shortage of around 49,000 workers in health and care (particularly in nursing homes and home care, as well as among geriatrics specialists, psychiatrists and medical support staff) (Government of the Netherlands, 2022). This shortage is expected to increase to 117,000 in 2030. The sector is characterised by poor working conditions, particularly high work pressure and relatively low salaries, particularly for nurses and low-skilled personnel, as well as physically demanding work, rigid processes and bureaucracy (Kreitzer et al, 2015). The model also seeks to reduce bureaucracy, allowing professionals to devote more time to caring tasks while at the same time rendering service delivery more efficient. The model was developed in 2006 in one locality in the Netherlands and is now available across the country, with 14,000 employees and has also provided inspiration for the development of similar

approaches in 30 countries. Evaluations have shown high levels of staff and client satisfaction with the model (Public World, 2016).

Policy measures targeting the activation of underutilised labour in the health and care sectors

Given the significant current and future labour force requirements in the health and long-term care sectors, the issue of tapping underutilised potential has also been addressed in at least three of the evaluated measures. The German **KAP**, discussed above, includes efforts to attract more men into care areas where they are currently underrepresented, seeking to address the issue of involuntary part-time (and temporary) employment and easing access for migrant workers. This last is at the heart of two further initiatives focusing on the more effective integration of refugees and migrants. Both measures are not solely focused on the health and long-term care sectors but have seen most significant activity in these areas.

The German **IQ** and the Swedish **Fast Track** measures seek to facilitate the recognition of migrants' qualifications gained abroad, to enable them to find employment at the level of their original education or training. Both measures include a wide array of concrete interventions, including the provision of advice, information and training to validate skills for both migrants and employers, language training or training on local culture/institutions.

These initiatives were initially developed to address higher levels of unemployment and underemployment among migrants and refugees, particularly following events bringing larger numbers of refugees to Europe. In the case of Germany, more than 1 million refugees arrived in the country in 2015 and 2016 (Mason, 2018), and nearly 450,000 first applications for asylum were registered in 2015, the highest number of asylum applications in Europe that year (Bundesamt für Migration und Flüchtlinge, 2016). Some studies have shown that these refugees (typically male and under 30 years old) are more likely to be overqualified than other migrants, with 60% of employed refugees having a tertiary education in skills for which EU Member States experience important labour shortages (digital and health- and care-related skills, etc.) (Betterplace lab, unpublished). Notwithstanding this, refugees are facing challenges entering the labour market, with the main barriers identified including language, cultural barriers and difficulties in officially recognising the qualifications achieved in their home countries. In this context, the argument for securing skilled labour by activating migrants with qualifications from abroad has become stronger. This situation is coupled with existing labour shortages in some professions (e.g. healthcare). In Sweden, up to 77% of Swedish employers reported a labour shortage of experienced healthcare professionals (Statistics Sweden, 2022).

Under the German measure, between 2015 and 2018 a total of 35,653 migrants received advice and 6,889 received training related to academic and non-academic health and social care professions (IQ, 2022), whereas 756 doctors, nurses, dentists and pharmacists received support as part of the Swedish intervention in 2016–2017 (Akademikerförbundet SSR, undated). No data are available regarding their integration into the labour market.

Both measures are characterised by close cooperation between different actors/stakeholders involved in the implementation of the policy measures. The programme architecture of the German measure is based on the regional IQ networks (composed of relevant regional labour market actors), which facilitates responsiveness to the regional/local labour market needs of the migrant communities by developing tailor-made approaches best suited to local and regional circumstances. The Swedish measure is based on close tripartite coordination between the government and social partners, with the latter agreeing to identify the specific sector labour shortage needs and also to develop clear and commonly agreed criteria for validating skills among newly arrived immigrants. The German measure has introduced minimum quality standards for advice services, prioritising the provision of certified training funded by the Federal Employment Agency. The measure has also attracted long-term funding, which has enabled the development of specialised knowledge and expertise and the building of strong networks. An online advisory service was introduced to cope with the COVID-19 pandemic. As a result, the number of advisory sessions delivered has remained stable.

Policy measures to enhance the use of existing labour and retain labour

Given the scale of the health and long-term care sectors and the time required to train specialist staff (among whom shortages are particularly common), and in the context of ongoing demographic trends among the general population and the healthcare workforce, measures to predict future demand are crucial, coupled with initiatives to ensure relevant initial and ongoing training. Training has an important role to play in contributing to career development, job satisfaction and retention. Finally, in the light of the challenging working conditions faced by healthcare professionals, rehabilitation for workers suffering from stress, burnout and associated mental health issues is another focus of policy measures to bolster retention.

These issues are addressed by the final three evaluated measures included in the review. The Dutch **Health Workforce Planning** model aims to forecast future demand and thus improve matching between supply and demand of health specialists by informing regional education and training policy solutions. The Advisory Committee on Medical Manpower Planning is a foundation set up in 1999 with the financial support of the Ministry of Health, Welfare and Sport, and it gathers data from the Central Statistics Office, professional registration databases, independent research, expert meetings and ongoing stakeholder dialogue to map

national and regional requirements for 79 different healthcare occupations on a 5- to 15-year time horizon. Several evaluations acknowledge the robustness of the model being used, and in general it is considered that policymakers respond to the recommendations by either curtailing or enlarging access to further training opportunities in the respective occupations (Van Greuningen et al, 2012; SEO, 2020). However, this does not provide a guarantee that training places will be taken up if broader issues persist in relation to the attractiveness of wages or working conditions in the sector. To address such issues, the Dutch government's Action Plan on Working in the Healthcare Sector (2018–2021) was the main measure aimed at reducing labour shortages, by improving access to training and lifelong learning; increasing access to flexible working; reducing administrative burden; and enhancing the use of technology in the sector. However, the impact of the plan, which had an associated budget of €450 million, was considered to have been insufficient, and further funding and additional resources were being considered at the time of writing, to address labour shortages in the sector.

Although the Austrian **FKS** measure is more broadly targeted than the healthcare sector, since its inception 70% of the individuals trained have been in the health, care and social professions. The PES-funded initiative provides support for training lasting between three months and three years to help address identified gaps in labour supply. Austria has a long standing shortage of workers in this sector (53,855 vacancies in 2019), which has increased significantly in recent years. In 2021, 65% of organisations in the health, care and social care sector reported labour shortages. Across all sectors covered by the measure, 90% of individuals were employed after participating in the training. The median wage increase following the measure averaged €530 for women and €200 for men (L&R Sozialforschung, 2020).

Enhancing access to training, particularly for workers who usually have more limited access to such opportunities (older workers, low-skilled workers), was at the heart of the German **WeGebAU** initiative. This policy, in place between 2007 and 2018 (and since replaced by a broader initiative entitled Weiter.Bildung) was not limited to the health and care sectors, but particularly in its final years of operation increasingly focused on training in these sectors. This measure gave financial assistance for SME employers to provide further training opportunities for employees traditionally underrepresented in further training (such as workers with a low level of qualifications and particularly those over 45) in order to encourage their retention in the labour market. Two key contextual factors explain the introduction of the measure. On the one hand, social care is one of the sectors particularly affected by labour shortages in Germany (Bundesagentur für Arbeit, 2021). On the other hand, unskilled workers have more difficulties in accessing labour market and training opportunities than their skilled counterparts. In the elderly care and nursing sectors, in 2020 there were only 26 and 47 registered skilled workers per 100 vacancies, respectively. This contrasts with a much more competitive situation for unskilled jobs, with 442 registered workers chasing every 100 jobs in elderly care, and 367 workers chasing every 100 in nursing (Bundesagentur für Arbeit, 2021).

Within this context, the policy measure has been shown to be successful, insofar as the available evaluations providing evidence that the intervention had an effect on both the retention and the remuneration of employees.[4] Thus it was found that, at the end of the second year following WeGebAU training, older workers were approximately 1.0–2.5% more likely to remain in paid employment than non-participants (and this difference was statistically significant), while participation by older workers in longer training activities had a positive impact on median monthly earnings (approximately €72 per month, on average; Singer and Toomet, 2013). The evaluation evidence also showed that the intervention reduced unemployment (45 days less over a five-year period for those participating in training). Employment and earnings effects were particularly high for women. The study attributed this result to three factors: women are concentrated in particular sectors (including healthcare); they receive longer training courses in these sectors, probably resulting in deeper knowledge; and women earn less in these sectors than men, which translates into larger relative gains for women than for men. However, it is worth noting that two cost–benefit analyses of this intervention concluded that the costs of providing the intervention in fact outweighed the benefits of delivering the programme (Dauth, 2020; Singer and Toomet, 2013).

Also focused on retention, the Spanish **PAIME** measure aims to prevent doctors suffering from mental health issues or addictive behaviour from exiting the labour market through the provision of rehabilitation services. It responds to a context characterised by a combination of labour shortages and poor working conditions, reflected in high levels of work-related stress. Recent studies in Spain estimate a growth of 8.9% in the demand for specialist doctors during 2018–2030, compared with a fall of 1.2% in the supply. More specifically, the deficit of specialist doctors in the Spanish national health system is expected to grow to over 12% from 2025 onwards, in comparison with an overall 2.9% deficit in 2018, and is mainly explained by massive outflows of professionals reaching retirement age (Barber Péreza and González López-Valcárcel, 2018). On the other hand, Spanish evidence (Olivar Castrillon et al, 1999) shows that the great emotional demands of health and care work lead to high levels of stress at work for these professionals, often resulting in exhaustion, burnout and, in the most acute cases, mental health problems.[5]

4 WeGebAU provides the strongest evidence of the impact of interventions aimed at enhancing the use of existing labour and retaining labour in the health and social care sectors, although it is worth noting that the evaluation evidence related not specifically to this sector but to low-skilled workers employed in SMEs in general. At the same time, this included a substantial number (around 30% of all participants) of employees working in non-medical healthcare, beauty and wellness jobs, and in medical technology/engineering, in particular elderly care.

5 By contrast, health professionals are one of the least targeted groups within the health system, either because of medical self-sufficiency, denial or minimisation of the illness itself, or because the affected person fears that their problem will be known and that this will undermine their professional prestige.

Spain: Supporting doctors with health problems

The Integrated Healthcare Programme for Sick Doctors (PAIME) in Spain is a support structure initially created by a medical association in one region of Spain and now available at regional level across the country. Doctors can refer themselves to the programme or be referred by other people (such as colleagues), or they may be required to participate if a formal complaint regarding their performance is considered to be rooted in mental health or addiction issues. The programme guarantees full confidentiality throughout. Some doctors continue to work while on the programme (around 60%); for others, their activity is temporarily suspended while they receive support.

The service begins with the provision of information about the PAIME programme and an individual assessment process, to determine the most appropriate care intervention. This can include a combination of medical, social, legal and other support services and can be delivered as inpatient or outpatient care. In serious cases, the doctor returns to work after being formally discharged from PAIME (this can also be a voluntary discharge) or when discharged from follow-up care. In some cases, a doctor may also be referred to other resources due to retirement, permanent disability or disqualification.

Source: *Authors based on case studies*

Monitoring data show that, following participation in the measure, 80% of doctors are able to return to work. Since its creation in 1998, around 5,120 doctors have been prevented from leaving the labour market. Among the success factors is the fact that the intervention has been conceived exclusively with the needs of doctors in mind, in the sense that the measure is specifically designed for medical professionals and implemented by medical associations, so sick doctors have at their disposal specialised healthcare that is not only differentiated from general healthcare but is also tailored to the specific features of each case. In addition, the network of collaborators (medical heads of risk prevention and occupational health services in health centres and hospitals) works together to cover the different phases of the PAIME process, including the detection, assessment and treatment of doctors targeted by the programme. Another key element behind the success of the policy measure is the figure of the PAIME coordinator in each association, who is responsible for coordinating PAIME activities at regional level, providing comprehensive care, and assessing legal, ethical and labour aspects, while guaranteeing confidentiality and confidence to the target groups. However, the policy measure is challenged by the existing funding limitations. In this regard, those responsible for PAIME aspire to incorporate the intervention into the public health system, as the main employer of healthcare professionals.

3 Tackling labour shortages in the ICT sector

Labour shortages of ICT professionals are among the highest in the EU.[6] Due to the increasing prevalence of the use of digital and ICT skills in the workplace – including as a result of the rise in remote working following the COVID-19 pandemic – and the fundamental importance of ICT and science, technology, engineering and mathematics (STEM) skills for modern manufacturing and service delivery, shortages in these skills have a significant impact on the ability of companies and sectors to innovate, improve productivity and enhance competitiveness. Based on national evidence from the countries with evaluated policy measures linked to these shortages (Austria, Belgium, Estonia, France, Germany, Ireland, Latvia, Poland and Portugal), there has been an upward trend in gaps in the number of workers with relevant skills in the ICT sector over the last 5–10 years, with forecasts generally predicting a further worsening of the situation. For example, in Austria 109,180 vacancies in the ICT sector were reported in 2019, up 181% from 2013. Close to 70% of surveyed IT service providers reported that they were severely or very severely affected by a shortage of skilled workers in 2021 (Dornmayr and Riepl, 2021). In the case of Belgium, a study by Agoria (Federation of Belgian Enterprises) highlighted that, in 2020, 58.8% had difficulties in filling ICT vacancies, and these difficulties were expected to increase in the coming years, since the demand for ICT labour is expected to grow (Agoria, 2020). Women comprise only around 17% of IT specialists and just 8 out of every 1,000 STEM graduates (aged 20–29). The share of female ICT graduates in Belgium is well below the EU average (2.1% compared with 3.9%).

In Denmark, a 2017 survey showed that around 25% of job announcements from Danish private companies required or asked for STEM skills and were linked to the digital transition (engineers, computer scientists, biostatisticians, etc.), with at least 10% of STEM-oriented positions never being filled (Burhøi, 2018).

In Germany, a study by Bitkom conducted in 2019 found 124,000 unfilled vacancies for ICT jobs (Hub.berlin, 2019). In France, data from DARES confirm that the ICT sector registered the highest level of shortages among all sectors in 2021.[7] In 2013, the additional workforce needed in the ICT sector in Estonia was estimated at between 6,600 and 8,500 (Jürgenson, 2013). By 2016, this figure had grown to 10,000; in 2021 it was estimated that it would be around 18,000 by 2028 (Mets and Leoma, 2016; Mets and Viia, 2021). According to the most recent available data, one-third of all difficult-to-fill vacancies in Ireland were in ICT (Cedefop, 2016; data for 2015). Italy has been characterised by a traditional lack of well-trained technicians (International Standard Classification of Education (ISCED) level 5) with a non-academic background in skills needed by SMEs, particularly in the digital domain. A labour forecast for 2021–2025 shows that at least 2 million jobs will require intermediate-level digital skills, and 900,000 of these jobs will require at least two out of three digital skills (basic digital skills, mathematics and computer science skills, implementation of 4.0 technologies) at a high level (Unioncamere, 2020). In Portugal, there is an estimated current shortage of around 15,000 ICT professionals (Anselmo and Charro, 2021, p. 51), representing a unique opportunity for Portuguese young people to gain qualified employment (Ferreira de Magalhães Pereira, 2017, p. 18).

Among the features of the ICT (and STEM) workforce is the underrepresentation of women, as highlighted above. In Austria, in 2019 only 20% of ICT specialists were women (15% in 2015), which is slightly higher than the EU average of 17% (EIGE, 2020). As mentioned above, only 17% of ICT specialists in Belgium are women, and only 8 out of 1,000 individuals aged 20–29 who have graduated in STEM are women.

Four of the 11 evaluated measures presented in this section focus specifically on increasing the representation of women in the labour market. One of these measures (**IT for SHE** in Poland) places particular emphasis on raising awareness of ICT careers among girls and women and hence increasing the attractiveness of the sector. The Slovak measure named after the NGO running the initiative (**You Too in IT**) also seeks to attract girls into further and tertiary ICT education and training, and women into ICT occupations and jobs requiring digital skills. Courses were launched in 2012 to provide women with digital skills and projects were subsequently extended to raising awareness among girls in schools. Due to the focus on raising awareness of careers in the sector among this target group, these measures are categorised as initiatives to enhance the attractiveness of the sectors, whereas the initiatives mentioned later fall under the category of 'integrating underutilised groups in the labour market', since they include elements targeted at overcoming other barriers to labour market entry. The other two initiatives aimed at women (**FiT** in Austria and **Interface3** in Belgium) thus not only provide guidance and training but also address other barriers faced by women seeking to enter the labour market, such as the shortage of accessible, high-quality affordable childcare. Both Interface3 and the German initiative **ReDI School of Digital Integration** are also targeted at individuals with a migrant background, and offer language training and networking to ease labour market integration. Young people from deprived areas and those not in employment, education or training (NEETs) are another target group for broadening the labour market

6 In some cases, there is an overlap between ICT and science, technology, engineering and mathematics occupations, which is why some of the initiatives also target the latter.

7 See https://dares.travail-emploi.gouv.fr/publication/les-tensions-sur-le-marche-du-travail-en-2021

for ICT professions, as shown, for instance, by the **GEN** initiative in France.

However, the largest number of measures seeking to address shortages in the ICT sector fall into the category of enhancing the use of existing labour and retaining labour, as they focus on identifying current and future skills needs in ICT (and STEM), developing curricula that match employers' requirements and delivering training to a variety of target groups. They also seek to address other issues such as the shortage of trainers and training providers, and greater challenges faced by SMEs in developing forward-looking training plans, and sourcing, financing and delivering ongoing training in ICT skills.

Table 6 summarises the goals, content, outcomes, and supporting and hindering factors of the evaluated measures targeting labour shortages in the ICT sector.

Table 6: Overview of policy measures targeting labour shortages in the ICT sector

Country	Title of measure	Main goals pursued and measures taken	Supporting and hindering factors
		Attracting labour	
Poland	IT for SHE	Facilitate the access of female STEM students and recent graduates to the male-dominated ICT sector. Enhance the attractiveness and knowledge of the sector, through mentoring activities with high-level experts in leading ICT companies, volunteering classes in programming and new technologies for primary school children in rural areas.	**Supporting:** Strong collaboration with employers and the involvement of mentors in the programme. **Hindering:** Shortage of female role models in IT professions and lack of knowledge about relevant occupations and training; cost of training and unsuitable training hours.
Slovakia	You Too in IT	Attract girls into further and tertiary ICT education and training, and women into ICT occupations and jobs requiring digital skills. Courses launched in 2012 to provide adult women with digital skills. Projects subsequently extended to awareness raising among girls in schools.	**Supporting:** Shift to online training during the pandemic enabled more girls and women in rural areas to participate in the measures. **Hindering:** Challenge of retaining sufficient financial resources for the NGO.
		Integration of underutilised labour	
Austria	FiT	Support unemployed women to gain access to male-dominated professions (ICT sector) through formal training activities, while at the same time reducing the average pay differential between women and men in the labour market and addressing labour shortages in the ICT sector. Address shortages by orientation, preliminary preparation and vocational training activities leading to formal qualifications, plus financial support to cover different costs while completing the qualification (unemployment benefits, course-related costs, childcare costs).	**Supporting:** Wrap-around support offered to women, including advice and guidance as well as childcare support; ability to try out different jobs, and detailed career guidance prior to pathway selection; networking with prospective employers. **Hindering:** Compensation (beyond covering training costs) only at level of unemployment benefit; balance of theoretical and practical instruction to be improved (with greater emphasis on work placements).
Belgium	Interface3	Support integration of unemployed low-skilled women, irrespective of age/migrant background, into male-dominated ICT sector/related occupations. Insertion into ICT professions in short supply as well as delivery of ICT skills for more administrative professions. Address skills mismatches through 9- to 14-month training courses in ICT-related skills, combined with an internship in a company, plus other supporting activities (language skills, project management, job search workshops).	**Supporting:** Awareness raising, opportunity to trial different occupations, regular updating of training content, strong partnerships in the community and with employers, combination of theoretical content with traineeships, complementing digital and other soft skills training. **Hindering:** Challenging and time-consuming to address stereotypes relating to the sector.
France	GEN	Respond both to labour shortages in the digital/ICT professions and to the difficulties of professional integration for NEETs from urban areas and women by developing GEN-labelled high-quality training courses in digital skills. Deliver individualised follow-up activities tailored to the specific difficulties encountered by each learner.	**Supporting:** High level of individualised follow-up and support to deal with other barriers such as accessing housing, healthcare or geographical mobility; post-training support also offered for preparing job applications, searching for internships, etc. **Hindering:** Lack of sustainability of funding; limited monitoring of results; lack of clarity of selection process of trainees beyond period of seed funding.

Country	Title of measure	Main goals pursued and measures taken	Supporting and hindering factors
Germany	ReDI School of Digital Integration	Free digital skills courses for migrants, asylum seekers and refugees as well as other citizens without access to digital education or a professional network, to facilitate their integration into society and the labour market. Career support programmes (job speed dating, mentorships, attendance at job fairs, matchmaking activities, communication and networking activities, company visits, technology talks and events) and soft skills (communication skills, interview training).	**Supporting:** Strong connection with companies and engagement of volunteers (including previous ReDI participants); diversity of staff team; adaptability to contextual factors (e.g. COVID-19). **Hindering:** Securing sustainable finance.
Enhancing the use of existing labour and retaining labour			
Austria	FKS	Provide support for training in shortage occupations lasting between three months and three years to unemployed people, self-employed people who have registered their business as dormant and workers wishing to pursue ongoing training. Allowance intended to cover cost of living expenses during training.	**Supporting:** Capacity of PES to provide financial support at the scale required, up to three years of training duration; availability of good-quality training providers and successful dual training system. **Hindering:** Little access to the measure for older workers; decreasing share of female beneficiaries.
Belgium	STEM Action Plan and Agenda	**STEM Action Plan:** Support the development and delivery of STEM qualifications in Flanders and increase awareness of and attractiveness of STEM occupations, particularly among groups less likely to select this training pathway (young people with migrant and difficult socio economic backgrounds). Increase the interdisciplinary presence of STEM subjects, as these will be widely needed for the green and digital transition. Offer retraining in STEM subjects for career changers and attract foreign workers with STEM profiles. **STEM Agenda:** Eliminate the shortage of STEM experts by 2030; achieve a 50/50 gender balance in STEM (no timeline); aim to have everyone make use of a regional STEM academy by 2025; increase digital literacy among young people to 100% by 2025 and to 100% among adults by 2030.	**Supporting:** Creation of a focus for the work to enhance the attractiveness of STEM and a hub for collaboration of all stakeholders. **Hindering:** Lack of actions aimed at encouraging adults to select STEM vocational training and retraining pathways; labour market shortages of STEM teachers; not all STEM subjects valued equally (e.g. craft-based pathways); lack of monitoring (all related to the 2012–2019 action plan).
Denmark	Technology Pact	Fund and develop initiatives to ensure that more younger people are attracted to and choose to engage in digital and technical STEM-related education programmes, to address labour shortages.	**Supporting:** Diverse partnerships including companies, research organisations, NGOs and government institutions; clear target setting. **Hindering:** Tendency for political change to be accompanied by a change in emphasis for the programme.
Estonia	Vali IT!	Bring new labour force into the ICT sector, through an intensive four-month retraining programme for employed and (more recently) unemployed adults with no previous work experience in ICT, including classroom learning and internship in a company (eight weeks following a bootcamp model) to provide them with entry-level software developer skills.	**Supporting:** Close collaboration with employers and public sector actors, which also ensures link with labour market requirements; strict recruitment criteria, which reduces dropout; strong word of mouth referrals. **Hindering:** Discontinuation of ESF funding means more trainees have to fund their participation; competition from increasing accessibility of microcredentials and modular vocational and higher education learning.

Country	Title of measure	Main goals pursued and measures taken	Supporting and hindering factors
Ireland	Skillnet	Facilitate and promote enterprise-led workforce training to employees and the unemployed, tailored to the sectoral and business needs of a given sector (in this case ICT) to help address labour and skills shortages.	**Supporting:** Lead role played by businesses in identifying shortages and developing content; making access to training more affordable for businesses and learners. **Hindering:** Devolved nature of the networks means that some are more active than others; delivery of training more challenging because of COVID-19, particularly in sectors relying more on practical instruction.
Italy	Tertiary Technical Education	Provide high-skilled workforce with wide technical and scientific competences in ISCED level 5 qualifications, with strong digital skills for different sectors and occupations. Enhance the attractiveness of upper high-level (non-tertiary) studies.	**Supporting:** Emphasis on cooperation between companies and education providers; strong partnership between social partners, regional government and education providers at regional level; mutual learning between providers. **Hindering:** Insufficient supply to meet demand due to the relatively new nature of this structure; regulatory framework under review; albeit lower than the labour market average, share of temporary contracts among graduates still high.
Latvia	LITKA projects I and II	**Project I:** Increase efficiency, productivity and competitiveness of SMEs through ICT and digital skills. **Project II:** Promote ICT qualifications in SMEs and among self-employed people to contribute to technological innovations and greater productivity. Project I offered more basic training and awareness raising on the importance of ICT and digital skills while project II offered modular programmes on the most recent ICT tools.	**Supporting:** Availability of EU funding; quality of training; blended learning approach; co-creation of training materials. **Hindering:** Wide variety of participants (different sectors) meaning that existing levels of ICT skills were quite different; limited time and financial resources for training; difficulty in building rapport between training providers and SMEs.
Portugal	Academia de Código Bootcamps	Requalify young unemployed individuals with no relevant skills/qualifications as computer programmers in order to reduce labour shortages in the ICT sector, plus networking/social activities with potential employers and other support activities (CV writing, interview preparation).	**Supporting:** Building a trusting relationship with employers to ensure they accept trainees who have completed a course of only 14 weeks; nature of course and high-quality equipment used helped to convey a 'cool and trendy' image; clear, measurable objectives set due to the payment-by-results approach. **Hindering:** Changes to company hiring policies meant more highly educated young people had to be targeted; older participants more difficult to place.

Source: *Authors, based on case studies*

Policy measures to attract labour into the ICT sector

The Polish **IT for SHE** initiative aims to facilitate the access of female STEM graduates to the male-dominated ICT sector and increase the attractiveness of the ICT sector for this specific group by raising girls' and women's awareness of the career opportunities on offer. The measure includes elements geared towards boosting female graduates' confidence and building their formal and informal networks. It sets out to break down gender stereotypes in relation to ICT employment through mentoring activities and volunteering classes to deliver training in new technologies for primary school children in rural areas.

Poland faces a paradoxical situation in the sense that, although women in Poland account for about 30% of all programmers, the proportion of women on ICT courses in tertiary education is much lower (around one-fifth of all students) (Women in IT, 2018). This could be indicative of the fact that more women acquire ICT skills as part of their jobs or through internet platforms in their spare time rather than through formal education. Participation in the programme steadily increased between 2017 and 2021. The measure has also been able to increase the number of participants working in the ICT sector (from 25% at the start of the programme to 51% of participants at the end, although this outcome is not identified in a formal evaluation of the programme). There is also qualitative evidence that participants gained knowledge about career opportunities in IT, acquired jobseeking skills and programming skills, increased their confidence and gained new professional and social contacts. The programme is run by the Perspektywy Educational Foundation, a private non-for-profit foundation established in 1998 and specialised in supporting young people in general, including fostering interest among girls and young women in male-dominated activities. The foundation has worked in close collaboration with several large ICT companies interested in attracting more women (these have acted as business donors and mentors within the programme) and with several universities involved in disseminating information about the programme among their female students.

You Too in IT in Slovakia also seeks to attract girls into further and tertiary ICT education and training and into ICT occupations. National data show that around 1,000–1,500 additional ICT graduates are required by the labour market (TASR, 2021). Courses were launched in 2012 to provide adult women with digital skills. Projects were subsequently extended to include awareness raising among girls in schools. Between 2012 and 2022, the share of women among ICT graduates grew from 5% to 15% (there is no formal evaluation that this is an outcome of the programme).

Policy measures targeting the activation of underutilised labour in the ICT sector

As mentioned above, women, migrants (or individuals with a migrant background) and refugees are among the key groups targeted as providing underutilised potential to enter the sector. However, in addition to having skills deficits, individuals from these target groups can face additional challenges that could hamper labour market integration. These include caring responsibilities and the lack of high-quality affordable care for children and adults/elderly people, language barriers and a lack of job search skills or networks, in addition to a dearth of information about training and career pathways in the sector, stemming from stereotypical perceptions.

FiT in Austria and **Interface3** in Belgium support unemployed (low-skilled) women to enter male-dominated ICT occupations, with reducing labour shortages in the ICT sector among their aims. Both emphasise the importance of guidance and trialling different types of training and occupations prior to making a final decision on the selected pathways, and both offer wrap-around support (in the case of FiT in terms of accessing benefits, help with childcare and the coverage of course-related costs, while Interface3 offers language training, CV writing skills and networking), which are considered to be among the key success factors for these measures. While the Austrian measure offers a variety of training opportunities lasting from 1.5 to 4 years, Interface3 provides training for up to 14 months, as well as in-company work placements.

Both policy measures have attained significant outcomes. **FiT** has been effective in supporting participants into employment, particularly in comparison with other programmes offered by the Austrian public employment service (L&R Sozialforschung, 2022). The measure can be seen as successful considering the proportion of people in employment three months after the end of the programme, which at 63% in 2021 was substantially higher than the average of 30% for other programmes of the employment service. An external evaluation also provided employment rates for 3–12 months after the end of the measure, compared with people who dropped out. Of those who completed it, more than half (55%) were in work after 3 months, 70% after 6 months and 81% after 12 months, which are considerably higher proportions than 36% after 3 months, 50% after 6 months and 62% after 12 months among the people who had dropped out. Further analysis conducted in the external evaluation showed that particular subgroups benefited from the measure to different extents; for example, young participants had a higher employment rate than older participants. Labour market data analysis showed that employment rates were sustained two years after the measure. In addition, the evaluation also found positive outcomes relating to the quality of employment, including salary, suitability of the job to the participant's qualification level and job satisfaction.

Austria: Getting unemployed women into ICT and technical occupations

The Women in Crafts and Technology (*Frauen in Handwerk und Technik*, FiT) programme is an ongoing initiative that began in 2006. It is funded and implemented by the Austrian public employment service (Arbeitsmarktservice, AMS) across Austria, albeit slightly differently in each region. In 2020, a total of 7,000 unemployed women were supported as part of the FiT programme with a total annual budget of €22.7 million (L&R Sozialforschung, 2022). The ICT sector is the main focus of FiT, although the programme also supports qualifications in skilled trades and technical jobs. The target group is unemployed women who want to access ICT, technical and skilled trades jobs in which women are underrepresented (i.e. less than 40% of the labour force) and are willing to undertake retraining over 1.5–4 years to access such jobs. While there is no specific target age group, FiT is primarily aimed at women older than the typical apprenticeship age of 16 years. It complements other measures, such as the promotion of ICT professions and training by means of the FKS programme mentioned above. The FiT programme activities are structured in three stages.

1. **Orientation phase (up to 10 weeks):** Participants receive information on selected artisan and technical occupations and get the opportunity to try out different types of skills. This phase includes practical training and concludes with an individual training and career plan.
2. **Pre-qualification phase (around 12 weeks):** Participants receive special technical preparation in the form of different courses or basic qualifications to develop the skills or qualifications needed to access the vocational training and the occupation of their choice.
3. **Vocational training (three years maximum):** Participants are given the opportunity to complete vocational training in the chosen occupation (through apprenticeships as well as vocational schools) paid for by the AMS, leading to a certified vocational qualification and/or school leaving certificate.

To ensure the programme is accessible, participants can receive unemployment benefits, financial support while completing the qualification, support for course costs, and support to cover childcare costs. The level of support varies by region, depending on local regulations.

The most recent data on labour market outcomes for women participating in the FiT programme show that almost two-thirds (63%) of women who completed the programme were in work three months later. The success rate varied across regions, though – it was lowest in Vienna, at 54.21%, and highest in Vorarlberg, at 77.32%. Overall, it was significantly higher than for other AMS programme participants (those who completed courses not funded by the FiT programme), whose success rate was as low as 30% in 2021 (L&R Sozialforschung, 2022). This is considered to be due to the wrap-around support delivered.

The 2014 and 2022 evaluations document similar success rates for different time periods. The 2014 evaluation found that one month after completing the programme 37.4% of participants (who completed the programme in 2011/2012) were in work. This percentage increased steadily as time progressed: 54.7% were in work after 3 months, 70.0% after 6 months and 80.9% after 12 months. This contrasts sharply with those who dropped out of the FiT courses: 36.2% of them were in work after 3 months, 50.1% after 6 months and 61.7% after 12 months (Egger et al, 2014). The main factors associated with how quickly participants were integrated into the labour market included age, nationality and completion of an apprenticeship as part of the FiT training. Similarly, a survey of almost 1,000 participants who completed a programme between 2015 and 2020, reported in the 2022 evaluation, showed that the majority (58%) were able to find a job within a month of completing the programme. The analysis also suggested that participating in the programme increased people's income by around 26–36% compared with before joining the programme. Income levels were higher for those completing apprenticeships and other types of in-company training programme – although there was an overall positive effect for all participants.

Source: *Authors based on case studies*

The Belgian not-for-profit association **Interface3** has trained nearly 6,000 women since 1987, the majority of them (4,950) between 2000 and 2022. Three-quarters (75%) of all women who participated in the training over the years were in employment after the training. In 2018, 70% of the 600 or so participants re-entered employment following course completion and 150 companies took on trainees.

Belgium: Encouraging low qualified women to train for digital jobs

Interface3 is an NGO engaged in continuing education and socio professional insertion in an effort to address the underrepresentation of women in ICT. It has since 1987 become the reference point in Belgium for equipping women with the skills to access a range of digital jobs. Funding comes from the national government and European sources and from private companies. It focuses on the integration of women from disadvantaged backgrounds. The typical profile of an Interface3 participant is a female jobseeker aged between 20 and 50 years with no educational qualifications or whose professional qualifications are unsuitable for the requirements of the labour market, often with an immigrant background. The programme now operates within the context of a broader national and cross-sectoral strategy for 2021–2026 called 'Women in Digital', whose aims are: to ensure more women graduate from the digital sector, to promote the integration of women into the digital world of work, to keep women employed in the sector, to boost the image of women in the sector, and to eliminate the gender gap in the sector.

The intervention is carried out in three stages:

1. Raising awareness and initiating training through orientation modules, short learning modules and projects to fight the digital divide (approximately five weeks in length).
2. Training through pedagogical methods that boost women's confidence in their ability to acquire the advanced technical skills needed for the targeted professions (these training programmes last between 9 and 14 months).
3. Specialisation and certification to guarantee recognition and development of an IT career.

After the theoretical training programme, an internship must be completed in a company. Interface3 has developed links with and connections in many companies in the ICT sector and not only provides trainees with contacts but also offers guidance, educational workshops, behavioural development courses and job search workshops, related to general and soft skills. In other words, this is a comprehensive package including career guidance, pre-training, person-centred skills training and job placement support. Moreover, Interface3 puts companies and students in contact, and manages information about the internships coming from these two parties.

In total, Interface3 organises 11 qualification courses, 7 orientation and initiation modules and several modules to support IT certification. Currently, among the 11 training courses leading to qualifications, 10 are aimed solely at women (there is just 1 course aimed at both women and men). Out of these 11 courses, 5 lead to ICT professions, 4 to administrative and commercial professions affected by ICT, and 2 to professions in the energy and logistics sectors. The nature and content of the courses have evolved in line with technological developments and labour market requirements.

Interface3 also gives career guidance and advice through information and awareness days. It also offers short introductory modules to enable women to try out different training courses in order to make an informed choice. Courses are offered free of charge.

Since its inception, Interface3 has trained 6,000 women, with a steep increase in the number of trainees between 2000 and 2022. In 2018, 600 unemployed women were provided with guidance and training, of whom only 64% held certificates of lower secondary education, and 53 nationalities were represented on the courses. A total of 70% of trainees were integrated into the labour market following the training, in around 150 different companies. In addition, 870 primary and secondary school pupils and their teachers participated in awareness-raising activities regarding opportunities in the ICT sector.

Table 7 provides an insight into the integration rates into employment from the different courses offered.

Table 7: Exit to employment rates from some of the training courses offered by Interface3

Course	Completion year					
	2017		2018		2019	
	Rate	Number of participants	Rate	Number of participants	Rate	Number of participants
Application developer	42.9%	7	41.7%	12	50.%	8
Office automation clerk	64.3%	14	50.0%	14	38.5%	13
Commercial office clerk	50.0%	12	85.7%	14	42.9%	14
Website manager	38.5%	13	69.2%	13	81.8%	11
Help desk technician	58.3%	12	55.6%	9	83.3%	12
Telephony and multimedia salesperson	36.4%	11	81.8%	11	50.0%	8
Totals	**49.3%**	**69**	**64.4%**	**73**	**57.6%**	**66**
Systems administrator	–[8]	–	88.9%	9	100%	11
Web developer	85.7%	14	84.6%	13	75.0%	12
Bookkeeper/accounting assistant	100%	15	83.3%	12	71.4%	14
Totals	**93.1%**	**29**	**85.3%**	**34**	**81.1%**	**37**

Source: *Bruxelles Formation*

The success of the programme is attributed to the combination of awareness raising, targeting of specific qualifications, development of strong partnerships and links with companies offering traineeships, and the regular updating of training content.

Source: *Authors, based on case studies*

Similarly aimed at the integration of migrants and refugees, the German **ReDI School of Digital Integration** seeks to address the fact that refugees in Germany are not able to access educational training offered by the public employment service until an asylum claim is approved. The duration of this process and associated lengthy absence from the labour market can render labour market integration more challenging. To address this situation, innovative models offered by NGOs and other training providers are the only alternative to traditional training provision models (AbuJarour and AbuJarour, 2020, p. 30). This is the case with the ReDI school, an NGO that combines free certified digital education courses with career support programmes for participants (job speed dating, mentorships, attendance at job fairs, matchmaking activities, communication and networking activities, company visits, technology talks and events) and the delivery of soft skills. Since its launch in 2016, ReDI has run courses in Germany for over 6,300 students with the help of over 4,700 volunteers and over 100 partners. Several external evaluations assessed a range of outcomes, from knowledge gains to entering the labour market. Some 54% of participants have applied for a job, 63% of them were invited for a job interview and, in total, about 33% were in employment at the end of the course. Compared with a control group, the proportion of participants who had completed a ReDI course and were unemployed was significantly lower: 18% compared with 34%.[9] Moreover, an alumni survey in June 2020 (n = 101) found that nearly half were employed in the ICT sector. In addition to participant-level outcomes, data also showed that 15% of current volunteers were former students. The training team within the ReDI school is very diverse, with staff members coming from over 20 countries, and many of them have also been refugees. ReDI has developed good connections with relevant stakeholders, in both the design and implementation phases. One of the key elements underpinning its successful results is the strong connections developed with private companies, which not only support ReDI financially but also foster the labour market integration of refugees by means of various career support activities. Notwithstanding these positive elements, the measure is challenged by the lack of sufficient stable financial resources. One of the main challenges for the organisation managing the measure is securing enough medium-term funding, due both to ReDI's difficulties in meeting the criteria for government funding and to the fact that ReDI's main income sources are corporate partnerships, often implemented as project-based funding for one year only.

8 This course did not run in 2017.

9 Since the control group had participated in a shorter ReDI intervention, the evaluation considered that the positive effects might be underestimated (Betterplace lab, unpublished).

Germany: Equipping migrants and refugees with digital skills

The ReDI School of Digital Integration is a non-profit technology school that offers free digital education courses to migrants, asylum seekers and refugees, as well as other citizens lacking access to digital education or a professional network. It was founded in February 2016 in Berlin. The first pilot programme was delivered in December 2015 to 12 students on two courses in Berlin. Since then, ReDI has continuously grown and expanded to different cities and even countries. By 2022, it had run coding and computer courses for over 6,300 students with the help of over 4,700 volunteers (teachers and mentors) and over 100 partners, and was represented in 10 European locations. It has since expanded to other locations in Germany and beyond (including Denmark, Ethiopia and Sweden) as well as delivering online programmes. As of March 2022, the ReDI School employed 68 staff (40 full-time equivalents).

ReDI has three fundraising arms, with the distribution varying by year: partnerships with for-profit organisations, partnerships with corporate foundations and government collaboration.

In terms of target groups, the ReDI School focuses on the most vulnerable, such as unemployed citizens. At least 50% of participants in every course must be people with a forced migration background.

The general objective of ReDI is to provide students with the knowledge and skills to help them integrate into the German labour market and society. Besides technical skills (through coding classes and technology workshops), ReDI provides students with soft skills (through human resources and interview training) and opportunities within their network of companies (through company visits, technology talks and events).

ReDI has been successful in building a trust-based community between students, volunteers and former students. ReDI has also been successful in building a network of more than 100 companies, which enables students to network and find job opportunities. This has created a win–win situation: ICT companies gain qualified labour, and refugees can more easily be integrated into the labour market. The list of ReDI alumni includes developers, engineers and data scientists for major ICT companies in Germany, as well as start-up founders. An alumni survey in June 2020 showed that, of the 101 participants who graduated between 2016 and 2019 and completed the survey, nearly half worked in ICT jobs and a quarter had non-ICT jobs.

The evaluation of the ReDI career programme in Germany showed that it had a positive impact on students' future aims and direction. Thus, 46% of the 173 students who completed the survey (response rate 49%) reported that they had gained clarity about their professional aims, 55% reported being clearer about their career path and 45% stated that they better understood the requirements of the labour market. Students also learnt about job-searching skills: 67% reported having a better understanding of application processes. Students gained new professional relationships as well, with 92% confirming that they had enlarged their professional networks. In terms of intermediate outcomes, more than half of the students (54%) had applied for a job at the end of the programme, and 63% of them had been invited to a job interview. At the end of the programme, one-third were in permanent employment. This proportion increased to 38% six months after the end of the programme, with only 18% still unemployed. The proportion of unemployed people in the control group was significantly higher, at 34% (Betterplace lab, unpublished).

Source: *Authors based on case studies*

With an emphasis on the target group of NEETs, the French **GEN** initiative tries to respond both to the need for skills in the digital/ICT professions and to the need for the professional integration of disadvantaged young people, particularly from priority urban areas. In France, around 2 million young people were considered to be NEETs in 2015. The situation was aggravated by the pandemic, with consequences such as increased job insecurity and problems related to poorer social relationships and mental health (DARES, 2021). The measure develops active labour market policies, combining GEN-labelled training courses in digital skills with individualised follow-up activities tailored to the specific difficulties encountered by each learner. GEN had achieved the labelling of nearly 750 training courses as of 2020, providing training for nearly 28,000 individuals. The number of learners increased from 1,600 in 2016 to 10,891 in 2019, with a drop in participation rates in 2020 due to COVID-19. In terms of outcomes for individuals, and referring to data for 2020, over 40% of participants were in employment and 26% in further training six months after completion of the training. Close to 80% of those who found employment were working in the ICT sector three months after graduation. These results are again primarily attributable to the wrap-around support offered.

Policy measures to enhance the use of existing labour and retain labour

Among the eight evaluated measures assessed for this study that aim to enhance and retain labour in the ICT sector, three take a more programmatic approach by seeking to combine a joint stakeholder assessment of education and training needs in the ICT and STEM sector with developing and updating relevant qualifications, ensuring the availability of training providers and delivering training. The Belgian **STEM Action Plan and STEM Agenda** for Flanders are multiannual programmes developed in response to the identified shortage of labour

in the sector/region. While the action plan (2012–2019) was more focused on the development of relevant partnerships, raising awareness about the attractiveness of STEM subjects and supporting the development of relevant qualifications, the agenda (2020–2030) is more focused on training delivery, with concrete targets for eliminating shortages and integrating women and young people into the field.

The **Skillnet Ireland** approach is aimed at facilitating and promoting enterprise-led workforce training to employees and unemployed people, tailored to the sectoral and business needs of a given sector (in this case ICT). For this purpose, Skillnet's business networks co-design and deliver these training activities. The Technology Ireland ICT Skillnet currently offers a wide range of qualifications including courses related to AI, blockchain, cloud computing, cybersecurity, data analytics and software development. Training ranges from short courses to master's-level qualifications. Skillnet's training programmes are highly flexible and pertinent to business and sectoral needs, since businesses within sectors facing labour shortages take a leading role in designing and targeting training content via Skillnet's business networks. Skillnet oversees quality standards to ensure consistency of quality across the different regulatory needs of different sectors and a uniform approach to training programmes and interventions. In terms of outcomes, only aggregate, non-sector-specific figures are available. In 2018, 54,159 employed and 2,023 unemployed individuals participated in training delivered by Skillnet. An online survey among participating businesses showed that 83% believed Skillnet helped them to address skills gaps generally within their organisation and management team, and 53% thought it increased staff retention. However, an online survey among participants found that while 13% of in-employment learners thought their salary increase was at least partially due to Skillnet training, just 2% attributed this primarily to this training. Furthermore, 13% attributed the securing of a promotion at least partially to the Skillnet training while 3% attributed it mainly to the training.

The Danish **Technology Pact** funded various initiatives and projects carried out by different stakeholders to raise awareness of/interest in ICT- and STEM-related studies/education programmes among students and young people. The evaluation shows that numbers of participants and companies exceeded targets and that, in the first year of the pact, from 2018 to 2019, the amount of STEM positions that were filled in the Danish labour market by people with STEM-related higher education increased by 3–4% (although it is unclear how much this can be attributed to this measure alone).

A particular focus on access to ICT training for micro and small enterprises is at the heart of the two projects implemented by the Latvian Information and Communication Technology Association, **LITKA**. Acknowledging the challenges faced by these companies in developing management and employee training plans on an ongoing basis and in sourcing affordable and relevant training, LITKA's first project offered awareness raising and training in areas such as ICT tools for financial management, web development, data processing and analysis, and digital tools for communication. Between 2012 and 2015, over 6,700 training courses were offered to around 3,250 participants from close to 1,450 companies. Based on an analysis of the financial results of participating companies and other micro and small enterprises, the company Lursoft established that profitability among participating microenterprises was 900% greater, and among small companies 25% greater, than among non-participants.

The remaining projects in this category of measures essentially focus primarily on delivering ICT skills training. Among these is the Austrian FKS measure described in relation to healthcare sector training above, so its details are not reiterated here. The other two projects, the Estonian **Vali IT!** and the Portuguese **Academia de Código Bootcamps**, follow a bootcamp approach, delivering intensive training over a short period of time, combining theoretical training with practical projects and employer meetups, and offering, in the case of the Estonian programme, an eight-week company internship. Both are explicitly aimed at addressing labour shortages in the sector. The Portuguese programme is closely associated with a regional development strategy aimed at attracting ICT companies to a relatively deprived rural region of the country.

Portugal: ICT training as part of a regional development strategy

The Code for All Coding Bootcamps (Academia de Código Bootcamps, ACBs) were implemented in Fundão, a rural town in Portugal's interior, between 2017 and 2020. The region suffers from low population density and is seen as a depressed part of the country. The measure was part of a broader local strategy to attract companies that employ software developers and to retain talent and young people in Fundão. The ACBs aimed to reduce labour shortages in the ICT sector to support this broader regional development approach. There was a particular interest in implementing the programme after the municipality was able to induce a large French ICT consulting company to open a centre in Fundão.

Specifically, the aim was to requalify unemployed individuals as computer programmers. The approach to funding was that of a social impact bond intervention. A social impact bond is a type of results-based contract that uses financing from social investors to cover the costs of implementing a given intervention: in this case, the ACBs. The sector, together with the private partners, defines concrete and measurable results to be achieved, and the investors are reimbursed for their investment if, and only if, these results are achieved. The ACBs have since continued in Fundão, although the bond funding has ended and they are now funded by other means.

The key aim of the ACBs is to requalify mainly young unemployed individuals as computer programmers. Of the 174 participants, around 64% had attended university; 34% of those had completed a bachelor's degree and 16% a master's degree. About 35% had completed secondary education or lower-level qualifications. The relatively high share of tertiary education graduates was conditioned by the fact that the hiring policies of many of the ICT companies in the locality required recruits to have university degrees. The national pattern of migration is away from rural areas, but in contrast 40% of ACB participants relocated to the region for the training. Only 16% of participants were women. The application process was relatively rigorous, with applicants required to take a free online 'introduction to programming course'. Only those who successfully completed the course were able to fill in application forms to participate in the bootcamp. Applicants also had to participate in a workshop and interview prior to selection. Bootcamps are full-time education courses lasting for 14 weeks, also including soft skills, networking with employers and social events (known as code breaks).

Over 70% of participants found employment following the intervention. Of these, 70% gained permanent contracts and many stayed within the municipality, which had also assisted them with housing and relocation costs. A cost–benefit analysis shows that the average cost of a typical training course in a government-funded active labour market policy measure is around €15,800, whereas the ACBs cost around €6,780.

Partly due to the ACBs, Fundão has been able to more or less maintain its population size in recent years.[10] Although Fundão's population decreased marginally by 0.6% between 2011 and 2021, overall the country's rural population decreased by 15.3% in the same period (City Population, undated; Macrotrends, undated).

Source: *Authors based on case studies*

The Estonian **Vali IT!** is a retraining programme for adults that provides entry-level software developer skills for people with no previous work experience in ICT, combining classroom learning with internships over an intensive four-month period. The programme started as a pilot project in January 2017 and has continued since. Between 2017 and 2021, it was co-financed by the ESF. It is now supported by the Estonian Unemployment Insurance Fund (by means of training vouchers) and by participants themselves (20% of participants fund their own training). It is aimed at individuals with higher education degrees in fields other than ICT and/or at least three years of work experience in a job requiring higher education in a field other than ICT. Monitoring data show that 55% of participants hold a bachelor's degree, 38% a master's degree and 1% a doctorate, and only 6% had not completed a degree. Applicants have to pass a second selection round using a special cognitive ability test (used as an indicator for suitability to work in ICT). Finally, interviews are conducted to complete the selection process. The gender split of participants is almost equal (53% women) and most participants are aged 26–40. The programme aimed to train 500 software developers between 2016 and 2021. This goal was almost met, with 567 persons starting the training and 12% dropping out. Three months after competition of the programme, 84% of participants were in employment (BCS Koolitus, 2021) and 60% of them worked in the ICT sector, in the following positions (ITL, 2021):

- 151 software developers
- 28 analysts
- 25 testers
- 19 project managers
- 35 others, such as UI/UX designer, product owner, lecturer

The rest either have their own businesses, have taken up internships, work in other sectors (not ICT-specific professions) or continued in their previous jobs.

During the COVID-19 pandemic, much of the training moved online, which is not considered to have affected the training negatively. A key success factor for the programme is the close collaboration between bodies from the public and private sectors, and particularly with employers. The strict recruitment process is also seen as important in preventing high dropout rates. Word of mouth has proved to be an important recruitment tool for the programme, which attests to its quality and impact. However, due to the high time investment required in selection processes and supervision, scalability of the programme is an issue, with relatively low intakes in each course. Another challenge to the programme is the increasing availability and flexibility of ICT training options in vocational and higher education institutes and through microcredentials, as well as online learning. With the ending of ESF support, financing is also an issue, particularly for learners unable to have their training funded or supported by the Unemployment Insurance Fund.

Both the Portuguese and Estonian programmes record very high levels of post-programme labour market integration rates. They show that short training courses can be effective in closing skills gaps, and demonstrate the advantages of teaching approaches focusing on the inclusion of soft skills, problem solving and teamwork, as well as the delivery of leadership skills. It should be noted that, in both cases, these successful outcomes could be conditioned by the rather rigorous selection process and relatively high educational requirements for entry. These also contribute to relatively low dropout rates.

The Italian **Tertiary Technical Education** policy measure is aimed at fostering the provision of official ISCED level 5 two-year courses to ensure the supply of a high-

10 Interview with the Head of Government Performance at MAZE, conducted 19 November 2021; see also Interreg Europe (2018, p. 5).

skilled workforce with wide technical and scientific competences (including digital skills) for different sectors and occupations (particularly SMEs). The measure is primarily aimed at young people who have completed secondary education. Its evaluation provides robust evidence of the outcomes relating to filling a gap in the Italian education and training system to develop technicians with qualifications at ISCED level 5. The provision of such courses grew from 63 in 2013 to 201 in 2019, with a parallel growth in student numbers from 1,500 to 5,100 registered students over the same period. Levels of participants in employment 12 months after course completion were consistently around 80% in this period. In 2019, this included 42% on fixed-term contracts, 31% on open-ended contracts and 27% working as apprentices. The impact of employing a graduate from this programme was also found to be significant in terms of total company productivity (+7.3%) and productivity per employee (+3.5%). The impact was largest among small and microenterprises, confirming the value of focusing this provision on such companies, and lower in the southern regions than in the northern ones. In this respect, the different qualities of the existing industrial relations and social dialogue practices among social partners and local governments between Italian regions explain the differences between northern and southern regions in the successful introduction of the policy (Salatin and Dordit, 2012).

Another key element sustaining the outcomes obtained by many of these policy measures in this category relates to continuous improvement to adapt to changes, including the revision of the curriculum based on labour market requirements and the presence of monitoring mechanisms to assess progress achieved and changes needed. The supply of training courses offered by the Belgian measure has constantly evolved over time in line with technological progress and the new/emerging demands of companies, enabling learners to take up training in technical occupations characterised by short labour supply. The Austrian policy measure has introduced several changes since the global financial crisis from 2008 onwards. Some of these changes have included the introduction of competence-based training and built-in digital competences in all programme modules as part of the pre-qualification phase, or the introduction of new types of jobs and hence qualification options to the programme as a result of labour market changes. Finally, the curriculum provided by the Portuguese measure was adjusted over the three-year intervention to ensure that training content was adapted to enterprises' evolving needs and that students learnt the programming skills most suited to the job market at any given time.

There are other elements underpinning the positive outcomes obtained. The Austrian public employment service has made major efforts to increase awareness of and access to the policy measure among employers, training providers and potential participants. For this purpose, the service has subcontracted external agencies in each region to sort out issues, provide advice on next steps, give encouragement or help to overcome particular barriers. Second, the crisis generated by COVID-19 has resulted in a great need to change the training approach, shifting from face-to-face training provision to more remote or blended learning practices (see the examples of the Austrian FiT, the Estonian Vali IT! or the Irish Skillnet measures).[11] In all cases, strong cooperation between different actors/stakeholders involved in the design and implementation of the policy measure is at the root of the positive results. For instance, in order to design appropriate training courses, Interface3 and LITKA work closely with their networks of collaborating companies to identify emerging skills and qualification needs resulting from technological and economic developments.

11 It is not clear if this type of training provision will continue in the future.

4 Tackling labour shortages linked to the green and digital transition

Green transition

Climate change is one of the megatrends affecting societies and labour markets globally. Its direct effect on living and working conditions, and the implications of climate change policies on sectoral and occupational structures, will require adjustments in initial and ongoing training and retraining for workers most affected by the shift towards carbon-neutral and more sustainable means of production and service delivery (Cedefop and OECD, 2021). A broad literature discusses the likely quantitative impact of carbon neutrality commitments and climate change policies. Despite differences in the assessed scale of employment impact, there is general agreement that, despite likely job losses in carbon-intensive sectors and energy creation, the job creation potential of 'green' and 'greened' sectors and occupations and of the circular economy outweighs such job losses (Eurofound, 2019, 2023a; Fragkos and Paroussos, 2018; European Commission et al, 2016). In this respect, short-, medium- and longer-term impacts also have to be distinguished (Fankhauser et al, 2008). It is also acknowledged that job gains may not be in the same regions and will require new skill sets, thus highlighting the importance of public policy intervention, particularly for more vulnerable workers.

Policy measures targeting labour shortages in occupations affected by the green transition

With reference to the countries in which relevant policy measures were covered by this study, in Austria there are major labour shortages in a number of occupational categories in construction, engineering, transport and energy production (Government of Austria, 2022), particularly in occupations related to the green transition (for instance, specialist skills required for insulation and green energy production) (Dornmayr and Riepl, 2021). In the case of Cyprus, estimates made in 2017 already indicated the need to provide green training to at least 4,500 workers in 13 different construction-related skills by 2020, basically in order to achieve the national targets for improving the energy performance of buildings (MECIT and Energy Service, 2017). In Ireland, an ad hoc Expert Group on Future Skills Needs expects that the demand for some occupations impacted by the green transition[12] will be between 22,000 and 27,000 by 2030, up from a demand for 5,000 people in such roles in 2020 (EGFSN, 2021). In Spain, the number of people employed in environmental activities increased from 158,500 in 1998 to 531,000 in 2009 (Fundación Biodiversidad and Observatorio de la Sostenibilidad en España, 2010). In Slovenia, the employment potential of the green economy was seen to be in the region of 85,675 jobs in eco-farming, 50,000 in sustainable forestry, 22,000 in renewable energy and 8,000 in waste management (no specific timeframe provided; Bogataj, 2016).

The complexity of definitional issues and the lack of good data sources on the precise skills and occupations required for the green transition are reflected in the policy approaches reviewed in this study that seek to address labour shortages in occupations affected by the green transition. Six evaluated policy measures solely or significantly focusing on this issue were identified and covered for this study, namely **klimaaktiv** in Austria, **WE-Qualify** in Cyprus, the **Just Transition Plan** in Ireland, active labour market policy measures or **AMU** in Denmark, the **Programme for Transition to Green Economy** in Slovenia and, finally, the ESF co-financed **Green Jobs Programme** in Spain. All of these measures fall under the category of enhancing the use of existing labour and retaining labour, with a strong focus on the development of relevant training curricula and the delivery of initial training and upskilling.

What is particularly notable about policy initiatives linked to the green transition is their strong emphasis on and connection with market building for green products, services and processes (generating demand and capacity). Furthermore, priority is accorded to understanding new tasks, skills and training requirements, developing new accredited curricula and eventually delivering such training. The Austrian **klimaaktiv** initiative seeks to deliver a holistic plan that ties the country's climate ambitions (for example, in relation to construction, retrofitting and sustainable mobility) together with training courses to be able to deliver on these plans, whereas in the Slovenian and Spanish initiatives the programmes were initially designed to deal with an oversupply of labour and deliver new jobs in emerging green sectors and occupations. Only later did the emphasis shift to focus more on emerging labour shortages which might inhibit progress towards climate change targets. The projects under the Irish **Just Transition Plan** are also linked to the country's Climate Action Plan, but are more specifically focused on ensuring fair transitions, particularly for the regions most significantly affected by the shift away from peat-powered electricity generation in the Irish Midlands). In Cyprus, **WE-Quality** is a follow-up project to BUILD UP Skills CY (part of the EU BUILD UP Skills initiative in the construction sector). The aim is to deliver on the desire to reduce energy use in domestic and commercial buildings to help the country meet the requirements of the EU Energy Performance of Buildings Directive. With previous initiatives having identified the areas of labour shortage,

12 For instance, professional engineering occupations associated with renewable energy, craft occupations related to housing retrofitting, built environment jobs and repairers of electric vehicles.

this programme was designed to create accredited training materials for specific occupations in the construction sector, develop relevant training capacity and begin to deliver this training.

Table 8 summarises the key contextual factors, goals and activities of these measures, outcomes achieved and identified supporting and hindering factors. These are discussed in more detail below.

Table 8: Overview of policy measures targeting labour shortages in occupations affected by the green transition

Country	Title of measure	Main goals pursued and measures taken	Supporting and hindering factors
Enhancing the use of existing labour and retaining labour			
Austria	klimaaktiv	Identify and address shortages of green skills in the labour market through stakeholder consultation. Develop new training curricula for initial and ongoing training, and financial support for training delivery for green skills, particularly in the construction, renewable energy, energy consultancy and mobility sectors.	**Supporting:** Presence of a holistic strategy combining building market demand with the supply of skills; networking supported by established social partner/social dialogue and business structures. **Hindering:** Lack of consistent centralised and regional labour market data on green skills requirements in order to plan training needs.
Cyprus	WE-Qualify	Three-year pilot project to help the construction sector in Cyprus address the lack of green skills among its workforce, especially as regards the construction of energy-efficient buildings, basically through the development and testing of pilot training programmes. Produce training materials (handbooks)/tools and trainer guides/manuals; deliver training activities for participants, and certification of these training activities. Focus on skills linked to installation of thermal insulation; installation of thermopanes and exterior sunshades; and installation and maintenance of biomass heating systems.	**Supporting:** Ability to build on existing experience and partnerships of previous BUILD UP Skills CY initiative (part of EU-wide BUILD UP Skills); roadmap produced by previous project guiding the selection of training to be developed; delivery of high-quality and certified training, not firm specific and not tied to a particular technology. **Hindering:** Resistance of established craftsmen in the sector to taking up training; difficulty in setting up training workshops that mirrored the challenges experienced on real life construction sites.
Denmark	AMU	Maintain and expand qualifications and professional competencies of both unskilled and skilled individuals (including self-employed and unemployed), while helping to solve adjustment and adaptation problems (labour shortages) in the labour market. Active labour market policy to address skills mismatches by provision of basic and further (certified) education courses of different durations (from one day to six months) offering theoretical instruction and work placement. Increasing emphasis on green skills delivery to meet market demand in the construction, manufacturing, agriculture, energy and transport sectors.	**Supporting:** Strong stakeholder involvement so new courses and adapted course content can quickly be identified and specified to meet shortages; broad range of offers and widespread geographical distribution of training provision. **Hindering:** Not free of charge for all courses or types of participants; disruption to delivery caused by COVID-19.
Ireland	Just Transition Plan	Improve existing mechanisms to anticipate green skills needs and improve access to lifelong learning in occupations relevant to ensuring Ireland's green transition, so the transition to a net zero carbon economy is economically and socially just, particularly in the regions most affected by the closure of peat-fired power stations. Provide green skills that are currently lacking. Supply activation and training activities for workers at risk from the decarbonisation process. Create additional community workplaces and supported workplaces in green sectors for at-risk groups.	**Supporting:** Drive towards green skills as part of an overall agenda towards emission targets for 2030 and 2050; current government coalition involving the Green Party strongly committed to renewables and other sustainable forms of production; financing available from EU Just Transition Fund and national sources. **Hindering:** Energy crisis deprioritised green transition to some extent.

Country	Title of measure	Main goals pursued and measures taken	Supporting and hindering factors
Slovenia	Programme for Transition to Green Economy	Facilitate the development of green technologies, create new green jobs and better manage natural resources (by means of a circular economy). Action area 3 focuses on the creation of green jobs including in sustainable forestry, waste recycling, natural resource management and sustainable food production. Activities include training for social entrepreneurs and subsidised local employment projects for people with disabilities, long-term unemployed, low-skilled people and Roma through job subsidies. Action area 8 is concerned with training and education for a green economy.	**Supporting:** Increased targeting of measures over the years. **Hindering:** Insufficient targeting of measures in 2015/2016; new calls for training projects in 2021 distinguishing between 'very', 'medium' and 'less' green activities being targeted; insufficient coordination between ministries responsible for the programme; insufficient emphasis on monitoring and evaluation.
Spain	Green Jobs Programme	Boost employment and business creation in the green and blue economies, through grants aimed at supporting projects to create jobs. Address skills mismatches by means of project funding, including funding of training activities to promote the greening of the economy and the employability of workers.	**Supporting:** Experience accumulated by Biodiversity Foundation after running the programme for over 15 years; strong focus on the green economy and stakeholder networking. **Hindering:** Bureaucracy associated with administration of ESF projects (but Biodiversity Foundation provides significant support to ease process for applicants); need for revised assessment of labour market needs for the green economy.

Source: *Authors, based on case studies*

The Austrian **klimaaktiv** programme coordinates and subsidises education and training activities in subjects relevant to occupations pertinent to the green transition, with a particular emphasis on vocational and lifelong learning in order to remove barriers facing consumers and enterprises in the use of energy-efficient technologies.

Austria: Removing barriers to the use of energy-efficient technologies

klimaaktiv was launched in 2004 as Austria's national climate protection and emissions reduction initiative, with the goal of removing barriers to the use of energy-efficient technologies faced by consumers and enterprises. It has four thematic areas of work: construction and renovation, energy efficiency, renewable energy, and mobility. Its initial goal was to assemble networks to inform its work and set new quality standards and requirements that would promote the implementation of energy-efficient technology in homes and businesses through subsidies, as well as providing advice and guidance on the use of such technologies (market creation).

In order to ensure that an increase in demand is matched with supply, as part of its broader programme, klimaaktiv coordinates and subsidises training and lifelong learning in subjects relevant to occupations pertinent to the green transition. The programme identifies training requirements, and skills and labour shortages, and aims to address the shortages particularly in construction, energy production, energy efficiency retrofitting and mobility. This is mainly done by making new training and qualifications available, and providing initial training and upskilling, for example in the fields of installing heat pumps in homes and repairing e-bikes.

Labour shortages and skills gaps are identified in consultation with stakeholder organisations and employers. Such information gathering is necessary because there is currently no national collation of labour shortage statistics specifically related to green skills or occupations. The OECD notes that, for lack of such measurement, the consequences of green innovation for skills demand in Austria are poorly understood (OECD, 2014).

Where surveys and consultations show that shortages are a barrier to the adoption of green technologies by businesses and consumers, klimaaktiv assists in expanding the availability of training and vocational courses leading to accredited qualifications. Shortages have been identified as an issue in relation to specialist engineers, fitters, plumbers and other construction occupations, transport planners and mechanics. In 2021, over 80% of employers surveyed by the Institut für Bildungsforschung (Institute of Vocational Research) in construction, engineering, transportation and energy production indicated that they were severely affected by labour shortages (Dornmayr and Riepl, 2021).

klimaaktiv has taken on the role of bridging what is sometimes perceived as the disconnect between different government departments responsible for climate and energy strategy and for education and training, by bringing together relevant networks of stakeholders and identifying and seeking to meet new skills needs for what are estimated to be 250,000 green jobs in Austria.

Source: *Authors based on case studies*

Around 100,000 individuals completed klimaaktiv training courses between 2011 and 2021. In 2022, there were around a further 21,000 trainees on klimaaktiv vocational training courses. They included 6,500 renewable energy professionals, 1,715 fuel-saving trainers and 237 e-bike technicians. According to the latest evaluation, 69.3% of klimaaktiv partners (in the building and renovation, energy saving, and renewable energies sectors) found the training and qualifications delivered by the programme to be satisfactory, with 47% rating the training as good or very good. Although the programme is having an impact and is favourably regarded by key stakeholders, its training provision to date has not been sufficient to significantly address labour market shortages in relation to Austria's green transition. Furthermore, evaluations do not provide data on the share of trainees entering employment in green jobs. However, the programme is generally evaluated positively, as it has contributed to the development of relevant national skills certifications, the identification of skills demands and the organisation of relevant training courses, as well as fostering collaboration between government departments and a range of relevant stakeholders engaged in boosting the take-up of energy-efficient technologies to meet the country's climate targets.

The Cypriot **WE-Qualify** project also has a strong focus on the home-retrofitting and construction sector, and builds on the partnerships and shortage areas identified in previous EU co-financed projects. In order to address national targets linked to the achievement of the requirements of the Energy Performance of Buildings Directive, it addressed the absence of accredited qualifications for installers of thermal insulation, thermopanes and exterior sunshades, and biomass heating systems. Following the development of relevant curricula, pilot training programmes were delivered to upskill the Cypriot construction workforce. Between 2013 and 2015, the project delivered five pilot training programmes resulting in the training of 92 technicians/installers and the certification of 76 technicians/installers. The evaluation of WE-Qualify shows that, overall, the measure has been successful not only in meeting its pilot objectives but also in generating a number of secondary positive outcomes. Crucially, the overwhelming majority of participants felt that the training they received through the project had helped them gain significantly more new knowledge and skills, and regarded their newly acquired skills as valuable for their job performance. At the same time, the majority believed that their WE-Qualify certificates would give them a competitive advantage in the labour market. Construction companies welcomed the training provided by the WE-Qualify project not only because it addressed the lack of appropriately trained technicians/installers by developing a bespoke programme, but also because it represented a valuable national (and coordinated) approach and scheme to support the upskilling of their technicians. In addition, they saw this training as complementing existing local and/or in-house training schemes, which such companies tend to run; it qualified workers to install systems from a range of providers rather than only selected systems. However, the scheme also met with some reluctance to access this training, particularly among workers with many years of experience in the sector, leading to below target levels of numbers trained and certified.

Although the Danish **AMU** measure for active labour market policy delivery is a well-established, general programme that delivers training to jobseekers, self-employed people and employees who require upskilling, it was included among the evaluations due to its process of continuous joint stakeholder assessment of skills needs and labour shortages, which underlies the training programmes it delivers. As a result, in more recent years there has been an increasing emphasis on the delivery of training to meet shortages in green and greening occupations and skills, particularly in the construction, manufacturing, agriculture, energy and transport sectors. Strong stakeholder involvement is seen to contribute to the timely identification of emerging gaps in the labour market and the timely development of new courses and course content.

As mentioned above, the connection with the overarching political emphasis on addressing climate change and reaching carbon neutrality targets is also evident in the reviewed measures from Ireland, Slovenia and Spain. Particularly evident in the case of Slovenian and Spanish programmes are the initial emphasis on market building and raising awareness of the shift to carbon-neutral technologies and sustainable business models, and the emphasis on (subsidised) employment creation in these sectors and occupations to help integrate more vulnerable groups into the labour market. The experience of the Slovenian programme in the early years of its implementation demonstrates the risks associated with a broadly focused approach lacking coordination between government departments and more local stakeholders, as many of the targeted initiatives and employment contracts initially failed to materialise because programmes were insufficiently targeted at green sectors and inadequate matched resources were available at local level to establish projects. In 2020, COVID-19 also proved to be a barrier to the delivery of training which could have supported the targeted number of employment contracts to be achieved. Based on evaluation evidence, the initial shortcomings of the programme design have been addressed more recently through a greater focus on work experience and training delivered in identified shortage areas from 2021 onwards.

The Spanish **Green Jobs Programme** was initially also primarily aimed at market building and skills needs identification. It particularly funds support for entrepreneurs active in relevant sectors to obtain training and deliver other supporting activities such as the development of tools for forecasting future green skills needs, development of pilot training programmes, production of training materials and certification of these training activities. In the 2007–2013 ESF funding period, the programme exceeded its targets in terms of the number of people trained and supported (more than 60,000 compared with a target of 50,000) and the number of companies created (1,100 compared with a target of 1,000). The results for the latest funding period (2017–2023) so far have been somewhat more modest due to the COVID-19 pandemic, with lower participation numbers and the need for course delivery to take place online. However, up until November 2021, 10,780 participants had obtained a relevant qualification, 316 had found employment (a full-time job with an employment contract for at least six months, in activities linked to the environment and the green and blue economies) and 1,484 had improved their employment situations (either obtaining a better job or being promoted within the same company). Surveys of participants also revealed high levels of satisfaction with the programme. In the Spanish context, where jobs created in the last 5–10 years have often been of low quality (temporary contracts, part-time, low-skilled jobs; European Commission, 2022d), one of the goals of the Green Jobs Programme was to improve job quality and sustainability.

The Irish **Just Transition Plan** is part of the country's broader Climate Action Plan, designed to reach 2030 and 2050 targets on the reduction of greenhouse gas emissions and climate neutrality, but focuses more specifically on support for the geographical areas most affected by the country's energy transformation and particularly the shift away from peat-fired electricity generation. Largely affecting jobs in the Midlands (Eastern and Midland region), the goal of the Just Transition Plan is to ensure a fair and socially responsible adaptation process.

Ireland: Supporting workers and businesses affected by the energy transition

The Just Transition Plan of 2019 is part of Ireland's Climate Action Plan. The action plan, last revised in 2021, sets out the country's approach to reaching EU and national climate targets, whereas the Just Transition Plan focuses on ensuring that this transition is economically and socially just. It involves a collaboration between the Department of the Environment, Climate and Communications, the Department of Education, Ireland's regional skills fora, the National Economic and Social Council and the Expert Group on Future Skill Needs, among others.

The EU Just Transition Fund granted €84.5 million for this purpose, which is matched by a similar amount of investment from national sources across a range of projects.

Although the whole country is affected, the main employment effects will be felt in the Midlands area, which has been heavily reliant on energy generation from peat collected from the surrounding bogland, together with the agriculture sector. At the beginning of 2019, around 1,000 people were employed at the commercial state-owned peat harvester Bord na Móna, although that number had been declining for many years; in 1980, it employed 7,100 people, with many others employed in contract work including seasonal peat extraction. Between January 2019 and May 2021, a total of 560 employees left Bord na Móna or were redeployed due to the closure of the two Electricity Supply Board power plants and the associated peat supply. Prior to these closures, the Littleton Briquette Factory and associated supply bog had closed with the loss of about 125 employees, and the closure of Bord na Móna coal distribution centres has led to the loss of 45 jobs before that. A further 70 jobs were lost at the Electricity Supply Board when the power plants closed.

One important focus of projects supported by the Just Transition Fund is the identification of future skills needs in the green economy and the development and delivery of suitable training, together with business support measures to encourage the creation or expansion of enterprises delivering services in this field, particularly in the geographical regions most affected by job loss.

A switch to businesses in the renewable energy sector is strongly emphasised in the Midlands, together with tourism ventures and the rehabilitation of the peat bog. Approximately 350 former Bord na Móna employees transferred to the Enhanced Decommissioning, Rehabilitation and Restoration Scheme; however, their new roles are deemed less secure than their previous roles. Bord na Móna itself has diversified and refocused its business as a climate solutions organisation (renewable energy production, recycling, peatland rehabilitation and sustainable product development). In 2021, plans to create 1,435 jobs in the Midlands by 2026 were announced (Mulvey, 2021). This clearly requires the delivery of new skills.

The Expert Group on Future Skills Needs identified skills gaps and projected labour shortages in a number of occupations, listed in Table 9 (National Skills Council and Expert Group on Future Skill Needs, 2021).

Table 9: Skills gaps and projected labour shortages

Occupation identified in the Just Transition Plan	Projected additional labour demand by 2030 under zero carbon scenarios relative to baseline projections	Total new entrants to labour market required by 2030 (additional demand and required number of replacements)
Professional engineering occupations in renewable energy sector	2,087	2,345
Craft occupations related to housing retrofitting	6,381	6,501
Built environment jobs including health and safety officers, chartered surveyors, etc.	22,564	67,021
Electric vehicle technicians	2,400	2,408

Source: *Authors*

The Just Transition Plan includes a broad range of actions including preparing a programme for the government to develop a green further education and skills development plan; promoting training for workers directly affected by the energy transition; creating community and supported workplaces in green sectors for long-term unemployed people, those who are economically inactive and those with severe additional needs; and enhancing careers advice services for those affected by technological and other changes. These and other measures are implemented locally on a project basis. In 2019 alone, 35 projects were supported by the Just Transition Fund, receiving around €10 million in funding. An upskilling initiative delivered green skills to 150 trainees. Further funding was dedicated to re- and upskilling Bord na Móna employees. Further significant training initiatives (for example, for a further 900 workers affected by the closure of the peat-fired power plants) are under way and have not yet been evaluated.

Source: *Authors based on case studies*

The planning process for the Just Transition Plan not only involved extensive stakeholder consultation, but also included learning from other areas in Europe affected by the withdrawal from fossil fuels (facilitated by the European Green Deal). Similarly, in the case of the Spanish Green Jobs Programme, the idea of developing the Green Business Network was inspired by a support platform for entrepreneurs that was being developed elsewhere in Europe. Transnational learning also formed an important part of the Cypriot WE-Qualify programme and its predecessors.

The active participation of different bodies/stakeholders in the design and/or implementation of the policy measures is also another key element underpinning the outcomes achieved by the different measures. For instance, the Austrian policy measure facilitates the setting up of partner networks formed of business representative organisations, individual enterprises and education institutes, as a means of increasing competence sharing with regard to rapidly emerging green technologies in the absence of robust labour market monitoring data for green jobs and skills. The Danish policy measure envisages two representative bodies (the Education Committee and the Adult Continuing Education Committee) where social partners and educational institutions can share experiences and advice and make sure that the courses are relevant, up to date and of a high standard. The Cypriot policy measure was effectively co-designed by a group of public and private partners with extensive and relevant experience in different fields. This group facilitated the development of training programmes and a set of supporting resources explicitly targeted at and adapted to the Cypriot construction sector's intermediate-skilled workforce.

Another important element underpinning the outcomes achieved is the continuous improvement and revision of the policy initiative (including the use of monitoring mechanisms) to ensure both that the policy remains pertinent to the new green transition demands and that emerging skills shortages are identified and addressed rapidly. In the case of the Austrian policy measure, the design and implementation of different vocational training courses is iterative, in the sense that each course is not only designed according to the different needs flagged by enterprises and their representative organisations but also constantly refined in response to continuous monitoring mechanisms that evaluate the successes and challenges faced by each course. In the case of the Cypriot intervention, amendments have been introduced several times in order to accommodate it to various reviews and recommendations resulting from consultations with businesses and their representative organisations. These amendments relate not only to the introduction of new training content (for instance, on health and safety at work issues) but also to the introduction of new training methodologies or updated training manuals. Interestingly, entities that benefit from the Spanish policy measure are invited to participate in evaluation surveys on training activities and experience acquired, and on other elements regarded as important (emerging training needs identified, preferences, etc.). These results are analysed by the Biodiversity Foundation, and taken into account for continuous improvement when designing calls for subsequent years.

In some cases, major efforts have been made to facilitate good access to the policy measures for potential target groups. In the case of the Danish policy measure, AMU courses are spread around Denmark, including remote or rural areas with lower population numbers, basically with the intention of covering all the Danish population so nobody is left behind. In addition, providing potential participants in AMU courses with active guidance and assessing their skills needs have significantly helped to improve participation in the courses. Interestingly, partners in the Cypriot policy measure had to make considerable efforts to persuade technicians/installers to take part in training, since most of them were either sole traders or workers in microenterprises and SMEs, which are much less likely to participate in formal training activities.

Digital transition

The digital transformation of the labour market and society is increasingly requiring citizens and workers to acquire new digital skills to adapt to evolving technologies on an ongoing basis. As indicated above, the second Cedefop European Skills and Jobs Survey found that in 2021 87% of the jobs in the EU required at least basic digital skills (Cedefop, 2021), with the pandemic having contributed to an increase in the digitalisation of European workplaces.

Since the ICT and STEM occupations addressed above largely require medium to advanced digital skills, it can be challenging to draw a line between policy initiatives targeting ICT and digital skills. For the purposes of distinction, the skills gaps addressed in this section tend to be of a more generic nature, emphasising the need to develop and update basic digital skills to fully participate in society and gain access to the labour market. Such initiatives can be targeted at citizens (such as Finland's Age of Artificial Intelligence), young people (including in schools), teachers, trainers (for example, the Swedish National Digitalisation Strategy for the School System and the Italian Growing in Digital), jobseekers (the French Skills Investment Plan, the Greek Digital Marketing Programme and Grow with Google) and indeed workers in need of upskilling to prevent their skills from becoming obsolete (see the examples of the Cypriot multi-company training programmes and the Luxembourg Digital Skills Bridge).

Policy measures targeting labour shortages in occupations affected by the digital transition

While a couple of the evaluated measures reviewed specifically target underutilised resources, including NEETs, the majority of interventions can be characterised as measures aimed at enhancing the use of existing labour or retaining labour, as outlined in Table 10. An important focus here is on assisting micro and small companies in determining the impact of digitalisation on their businesses, establishing how they can better exploit such technologies to enhance competitiveness, and assessing the skills of the existing workforce to determine (and deliver) the additional training that might be needed.

Table 10: Overview of policy measures targeting labour shortages in occupations affected by digital transition

Country	Title of measure	Main goals pursued and measures taken	Supporting and hindering factors
Integration of underutilised labour			
Germany	Jobstarter plus	'Innovation lab' or 'development programme' testing solutions for cooperation between vocational education and training bodies in order to support SMEs to address labour shortages. Activation through training of underutilised human resources (migrants, people who have dropped out of school). Development of marketing concepts for particular occupations; specific advisory service for SMEs in sectors with job matching difficulties.	**Supporting:** Regional network structure engaging strongly with regional policy actors and employers; focus on requirements of regional labour market and training providers; existence of network structures; emphasis on needs assessment in relation to digitalisation and development of targeted training. **Hindering:** Since SMEs were often at the start of the journey in terms of digital transition, preparatory work needed on awareness raising and needs assessment; funding only available for 36 months meaning trainees could only be offered fixed-term contracts.
Italy	Growing in Digital	Promote digitalisation and digital culture and skills in Italy, especially among small and microenterprises, by enhancing the digital skills held by NEETs. Free online 50-hour training courses plus six-month internship periods for participants (including a monthly participation allowance of €500 per participant) in one of the candidate host companies, and economic incentives (maximum of €8,060) for companies hiring participants with a labour contract of at least six months.	**Supporting:** Close alignment with the national Industry 4.0 policy; partnership with private companies; ability to engage with NEETs to help integrate them into the labour market; financing available for internships. **Hindering:** Poor coordination between national and regional levels; more accompanying support needed for participants to increase completion and pass rates.
Enhancing the use of existing labour and retaining labour			
Cyprus	Multi-company training programme	Financially support the participation of workers (and, since 2015, the (long-term) unemployed) in training programmes, designed and implemented by certified vocational training centres to meet companies' training needs. Address skills mismatches through grants to employers for approved training, allowances to trainees and financial assistance for obtaining training equipment. In general, 80% of total fees for participants covered, rest covered by participants.	**Supporting:** Evidence-based training based on PES labour market analysis; strong social partner involvement; emphasis on certified training; financial support for employers. **Hindering:** Flat rates of payment to training providers; bureaucracy linked with access to subsidy; low interest among long-term unemployed people in participating; attracting relatively high share of highly qualified people (43% in 2017–2018).
Finland	Age of Artificial Intelligence	Make Finland a frontrunner in AI applications, through different activities to equip the general public with AI skills to assist them both in their employment and in their everyday life.	**Supporting:** Extensive stakeholder network to develop and regularly adjust the content of the programme. **Hindering:** Unclear whether policy focus should be on upskilling existing workforce or attracting high-level experts from abroad; tendency for online education to be taken up more by individuals who already have higher-level education.
France	Skills Investment Plan	Increase digital and other skills of the least qualified people, including low-qualified unemployed people and young unemployed people with socio economic barriers to employment. Assess and certify digital and transversal competencies; provide innovative activities fostering labour market access of specific groups or ad hoc training activities for participants to address the needs of the labour market.	**Supporting:** High level of multiannual investment; priorities adaptable to regional contexts; holistic activity tailored to the most vulnerable groups; innovative approaches to training; support with life skills. **Hindering:** Challenge of fully individualising training pathways; fluctuating regional economic and labour market requirements, and challenging to quickly adapt plans; most vulnerable groups less likely to access training.

Country	Title of measure	Main goals pursued and measures taken	Supporting and hindering factors
Greece	Digital Marketing Programme Grow with Google	Increase digital skills for the labour market among unemployed young people through the delivery of online vocational education and training programmes for certified digital marketing skills. Participants receive 75 hours of online training, with those completing the course having the opportunity to participate in a subsidised six-month work experience programme.	**Supporting:** Effective collaboration between the Greek PES and Google Hellas; training design according to labour market needs. **Hindering:** Limited work placements offered; limited evaluation data on labour market integration.
Luxembourg	Luxembourg Digital Skills Bridge	Foster the modernisation of Luxembourg businesses by upskilling employees in companies affected by digital transformation. Prepare and train for labour market change, by analysing the impact of new technologies in the company and identifying employees/job positions in need of upskilling/reskilling; co-fund formal certified training activities for participating employees (including a personal coach); financially support companies to cover the salary costs of the participants while in training.	**Supporting:** Available funding encouraging businesses to participate; comprehensive skills assessment for employees and individualised technical assistance for companies. **Hindering:** Same support approach used for all companies irrespective of sector and type of company; greater barriers for smaller companies.
Sweden	National Digitalisation Strategy for the School System	Improve teachers' digital skills so that they can teach the pupils relevant digital skills as well as ensuring that these digital technologies are used in the best possible way to ease the workload of teachers.	**Supporting:** Broader digitalisation strategy meaning this schools initiative is embedded in a broader framework; access to digital tools in Swedish schools already at a comparatively high level. **Hindering:** Targets vague; according to trade union survey, 55% of teachers' teaching (grade 7–9) interrupted by IT problems and 10% with insufficient IT support.

Source: *Authors, based on case studies*

Policy measures targeting the activation of underutilised labour in occupations affected by the digital transition

Two policy measures (the German **Jobstarter plus** and the Italian **Growing in Digital**) are aimed at activating underutilised labour in occupations affected by the digital transition. Both primarily seek to support SMEs and microenterprises in closing skills gaps by assisting them in integrating vulnerable groups into the labour market. Both count NEETs among their target groups, with the German measure additionally targeting migrants who also face challenges in entering the labour market. The German policy measure is aimed at funding and supporting various types of innovations intended to strengthen vocational training activities in Germany. It operates through the funding of specific regional projects, with different focus areas in the various funding rounds. Four key elements underpin the rationale behind supported projects:

- development of new marketing concepts for particular occupations aimed at new target groups (e.g. people who have dropped out of school or university and individuals with a migration background)
- organisational innovations, including the systematic involvement of new actors in the process of sourcing and delivering training and attracting new target groups
- service innovations to develop training concepts to support specific target groups (such as language training for migrants)
- social innovations, such as raising various entities' awareness of the needs of different target groups, in order to support innovations in the recruitment process

Since 2014, Jobstarter plus has funded 231 projects supporting a total of 24,000 SMEs. Of these SMEs, close to 40% had previously never (or not for a long time) offered training positions.

The Italian policy measure promotes digitalisation and digital culture and skills. It offers free 50-hour online training courses in digital skills for NEETs plus six-month internship periods in one of the host companies for participants, and economic incentives for companies hiring participants. An evaluation of the programme found that 12.5% of participants were hired within 1 month of the conclusion of the internship and this share gradually increased to 30.4% 12 months after completion of the programme. Evaluation evidence showed that, among all graduates of the programme, 44.7% were currently employed and 66% had been in employment at least once after finishing their internship.

Good collaboration between a range of policy actors is considered to be key to successful policy outcomes. In

the case of the German measure, each funding round is designed by a steering committee (made up of scientific experts and representatives from business associations, trade unions, the regions, federal ministries and the federal employment agency) to reflect on agreed policy priorities. In addition to this, grant recipients must submit annual monitoring reports to ensure implementation is working towards the project goals and milestones are being reached. In the case of the Italian measure, positive outcomes are considered to be the result of a successful collaboration between the National Agency for Active Labour Market Policies of the Italian Ministry of Labour and Social Policy, Unioncamere (the Italian Union of Chambers of Commerce) and Google. The measure has benefited from large amounts of funding from Italy's Youth Guarantee programme, which have resulted in very powerful incentives for employers to participate in the measure (such as full financing of internship periods plus recruitment bonuses).

Policy measures to enhance the use of existing labour and retain labour in occupations affected by the digital transition

Seven assessed policy measures are aimed at enhancing and retaining labour in occupations affected by the digital transition, namely the Cypriot multi-company training programmes, Finland's Age of Artificial Intelligence, the French Skills Investment Plan, the Greek Digital Marketing Plan and Grow with Google, the Luxembourg Digital Skills Bridge and, finally, the Swedish National Digitalisation Strategy for the School System.

The Finnish policy measure **Age of Artificial Intelligence** acknowledges the increasing pervasiveness of digital technology and AI in particular. Aimed at all Finnish citizens (including those in work) interested in increasing their skills in and knowledge of AI, it is intended to make Finland a frontrunner in AI applications, through various activities including the development of an ad hoc massive open online course on AI ('Elements of AI MOOC') to equip the general public with AI skills to assist them both in their employment and in their everyday life. Access to the course is global. Since its establishment, 750,000 individuals worldwide have participated in the online training. In Finland, 2% of the total population have taken the course.

Aimed at upgrading the digital skills of the future workforce through its enhanced integration into the school curriculum, the Swedish **National Digitalisation Strategy for the School System** provides a framework and explicit national goals for increasing the digitalisation of the Swedish school system and improving teachers' digital skills, so that they can teach the pupils relevant digital skills as well as ensuring that these digital technologies are used in the best possible way to ease the workload of teachers.

In order to improve the match between jobseekers and the requirements of the labour market, the French **Skills Investment Plan** aims to enhance the digital (and other) skills of the least qualified people, including low-qualified unemployed people and young unemployed people with socio economic barriers to employment.[13] It includes a wide array of different types of interventions such as assessment and certification of digital and transversal competencies, innovative activities fostering the labour market access of specific groups and ad hoc training activities for participants. Accessing such training programmes was found to have a positive effect on labour market integration rates 3, 6 and 12 months after completion of these courses. After one year, 38% of participants were engaged in some form of training, while 21% were engaged in some form of training leading to a certificate. The study compared this success rate with that of similar young people who did not receive support and found the training participation rate 6 months after joining the programme to be 16.5% higher than for those who did not participate in the scheme. Similar findings were reported with regard to employment rates 6, 12 and 24 months after starting the programme, with a 7-percentage-point difference observed between those who did and did not access such a scheme. A positive effect was also observed on job quality, with better access to open-ended contracts for the unemployed people who had received the training. However, a very low effect on the employment rate for young people was detected (1 percentage point of difference between those who had and those who had not received the training).

The Cypriot **multi-company training programmes** financially support the participation of workers (and since 2015 (long-term) unemployed people) in training programmes, designed and implemented by certified vocational training centres so as to meet companies' training needs and enhance the productivity and competitiveness of the companies involved, as well as the employability of workers and unemployed people. For this purpose, the measure addresses skills mismatches by means of grants to employers for approved training as well as allowances to trainees and financial assistance for obtaining training equipment. While the training is not solely focused on digital skills, they have been a focus of the programmes in recent years because 45% of Cypriots aged 16–74 have only basic digital skills, 25% have more than basic skills and 46% have basic software skills (below the EU averages of 56%, 31% and 58% respectively). In 2020, 185 participants took part in digital skills training. An evaluation based on telephone interviews and focusing on all participants in 2015–2016 found that almost half (46.6%) of the participants in the measure were employed 15 months after programme completion, two in three (67.3%) thought that their participation improved their employment prospects, and the vast majority of participants were either satisfied or very satisfied with the programme (90.2%) and would recommend it to others (98%). Despite these positive results, the evaluation also found that unemployed graduates and/or younger cohorts of the unemployed were overrepresented among programme participants. This, in turn, meant that other groups with low participation, such as older unemployed

13 In France, most of the existing training in digital skills is developed within the higher education system, so disadvantaged groups have had no access to this type of training supply. This situation was one of the key reasons behind the introduction of the Skills Investment Plan.

people and/or the low qualified, are less likely to take part. A later survey, focusing on unemployed participants only, found similar positive results, albeit to a lesser degree than the previous one (unsurprising given the focus on unemployed people only). Almost 4 in 10 (39%) of the participants were employed seven months after programme completion, with satisfaction rates once again very high among participants. These positive results notwithstanding, again the evaluation also pointed to some issues, notably the low take-up of available training places by the unemployed and some underutilisation of available training places across the programmes (HRDA, 2018).

The **Luxembourg Digital Skills Bridge** aims at upskilling employees in companies affected by digital transformation (regardless of their activity or size), through both technical and financial support ranging from analysis of the impact of new technologies in the company, and identification of employees/job positions in need of upskilling/reskilling, to co-funding of formal certified training activities for participating employees, and financial support to companies to cover the salary costs of participants while in training. In the pilot project, 187 employees completed a personal training plan in the context of the programme. Qualitative evidence suggested that taking part in this pilot project provided a competitiveness boost and a positive social image to participating companies. Although the pilot project has now come to an end, it is planned to continue a similar initiative, taking on board the learning from the pilot project (data provided for this study by the public employment service of Luxembourg).

Among the factors underpinning the positive outcomes of the measures discussed above are the targeting of approaches to the needs of specific groups (such as migrants, NEETs, low-skilled workers, SMEs and so on), the involvement of relevant stakeholders at regional and local levels in the design and implementation of measures, and the facilitation of participation through financial support, targeted awareness raising and the reduction of bureaucratic barriers.

5 Assessing the evaluation evidence

The above discussion provides some insight into the nature and quality of data generated by the evaluations carried out in relation to the 40 selected policies. It is important to reiterate that these were selected from a list of more than 100 measures because the available literature indicated the availability of good evaluation evidence in respect of these 40 measures and the inclusion of some of the approaches in repositories of good practice.

Evaluation is the cornerstone of evidence-based policymaking. Over the past decades, there has been increased emphasis on the importance of evidence-based policymaking in ensuring that measures can be shown to be effective and efficient and to provide a good cost–benefit ratio in terms of value for money from what tends to be largely public investment. At EU level, the Better Regulation Guidelines call for *ex ante* impact assessment and *ex post* policy evaluation of legislative and policy initiatives; and European funding frameworks such as the ESF have successively increased emphasis on the requirement for monitoring and evaluation, including counterfactual impact evaluation (European Commission, 2021c).

While impact evaluations aim to assess if and to what extent the policy/intervention works, process evaluations aim to understand how and why the policy/intervention works. Together these provide important information for policymakers. In recent decades, evaluations of labour market policy have significantly increased in number (Eichhorst and Konle-Seidl, 2016). Improvements have been made regarding evaluation methodologies and data quality, although this differs by Member State (Card et al, 2010). Methods differ from experimental design using random assignment to intervention and control groups to non-experimental methods. At the most basic, only output-monitoring data are gathered to demonstrate how resources have been spent.

For the purposes of this study, the quality of evaluations has been assessed along an 'evidence journey', indicating where the strength of the evidence is on the evidence journey, from no evidence to very strong evidence. Table 11 shows a description of each of the six evidence assessments. Basic and incomplete evidence indicate that no robust evidence is available that supports the effectiveness of the intervention or policy. Medium evidence implies that there has been some consistent research including pre- and post-tests. Evidence of policy measures is rated as strong or even very strong when it includes robust large-scale studies with comparison or control groups.

Table 11: Overall assessment of the strength of evidence

Rating	Description
No evidence (0)	No evaluation or monitoring evidence since 2016 is available for this policy.
Basic evidence (1)	This is likely to involve no robust empirical evidence, although some qualitative or anecdotal evidence from participants indicates that it is seen as having a positive impact, there are some basic monitoring data to measure inputs and outcomes or it has been identified as good practice by external organisations (such as OECD, European Commission, World Health Organization, Cedefop, Eurofound).
Incomplete evidence (2)	There are some findings but the evaluations are not consistent or robust enough to be sure. This is likely to include small-scale empirical studies with no control groups, qualitative case studies, and monitoring of the input, outputs and outcomes of the intervention.
Medium evidence (3)	The programme or practice is based on sound theory informed by a body of robust empirical research. This is likely to include cohort studies using pre- and post-treatment scales, as well as some small-scale or explorative randomised controlled trials (RCTs).
Strong evidence (4)	The policy or intervention has been rigorously evaluated using theory-based evaluation methods. This is likely to involve at least one large-scale cohort study and/or RCT with valid comparison/control groups.
Very strong evidence (5)	Multiple theory-based quantitative and qualitative robust evaluations of the impact and outcomes of the intervention have been made. These involve longitudinal studies such as large-scale cohort studies using pre- and post-treatment scales, and/or RCTs with valid comparison/control groups.

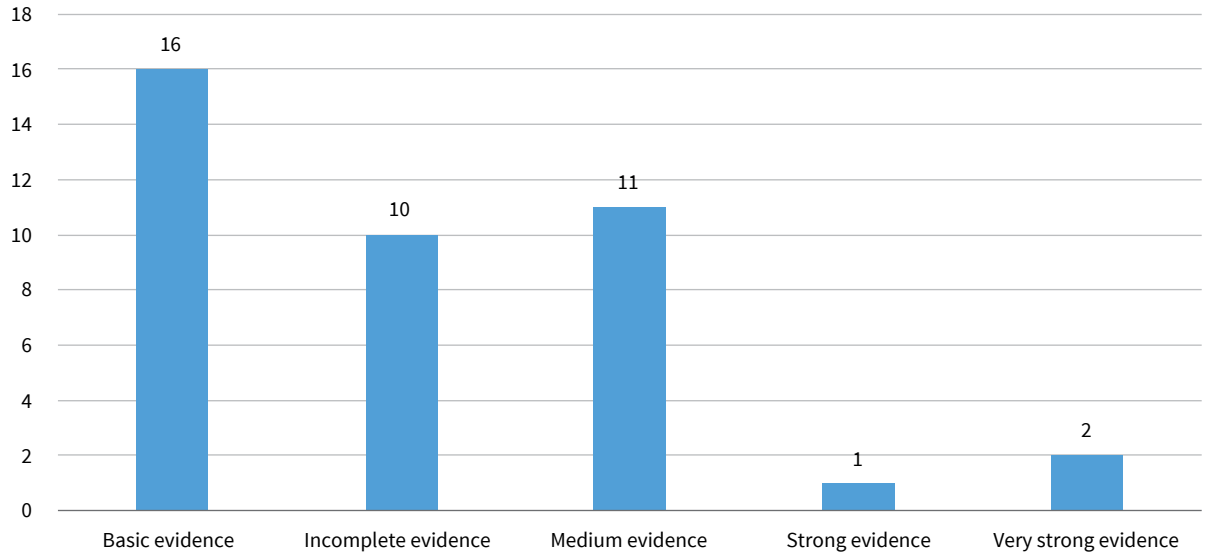
Source: *Authors*

To put in context the above discussion of the policy measures implemented to address labour shortages, and their outputs and outcomes, this section provides a brief overview of the nature and quality of the evaluations conducted of the 40 analysed policy measures. Information about the evaluations is based on the case study reports produced as part of this research. The main finding is that much remains to be done in relation to evaluation design and methodology, particularly as regards the assessment of outcomes (in this case, the impact of a policy measure on labour shortage in a given

sector or occupation). Evaluation strategies should be part of a robust theory of change, clearly setting out the intervention logic of a measure, the steps to be taken and how these should contribute to achieving the desired goals. Goal setting should ideally be linked to measurable targets, with evaluation design ensuring that the required data are being gathered to allow for a robust assessment of effectiveness, efficiency and cost–benefit ratio. Despite the increasing availability of policy guidance on the design and commissioning of evaluation, this is currently rarely the case, and a more active discussion is needed on capacity and data gaps, which need to be addressed to make better evaluation design a reality.

Figure 18 shows the overview of overall assessments of evidence rating across all 40 analysed policy measures. While no measure had no evidence, more than half (65%, *n* = 26) had only basic or incomplete evidence. Fewer than one-third of case studies (27%, *n* = 11) were rated as being accompanied by medium evidence, and only three measures were supported by strong or very strong evidence. None of the evaluations provided a clear assessment of the impact of the measure on the scale of labour shortages in the sector/occupation in question.

Figure 18: Frequency distribution of overall assessment of evidence



Source: *Authors, based on case studies*

When comparing the evaluation approaches and methodologies in greater detail, the following findings can be highlighted.

External evaluation: All measures collect routine monitoring data, including participation/uptake and partly also characteristics/demographics of the target groups. Of the 40 case studies, 21 had at least one external evaluation commissioned, which also means that 19 case studies relied on internal evaluations alone. We compared the evidence ratings of all case studies that had at least one external evaluation with the case studies that had only internal evaluations. This comparison showed a slightly higher average rating of 2.5 for externally evaluated measures than the average rating of 1.6 for only internally evaluated measures. For example, the 3 measures with strong and very strong evidence, and 7 out of the 11 measures with medium evidence (64%), included at least one external evaluation, whereas the majority of the measures with basic evidence (13 out of 16, 81%) were not independently evaluated.

(Quasi-)experimental design: Counterfactual impact evaluations using a comparison group design are regarded as being able to provide reliable information about the effectiveness of interventions when carried out appropriately. Six measures had evaluations conducted that included a comparison or control group, using either available administrative data such as employment statistics or primary data derived from online questionnaires. Primary data collection included participants in different programmes of the same organisation completing the same evaluation tools, to be able to compare progress with the intervention group. Evaluations with a quasi-experimental or experimental design were carried out for the Austrian FKS, the French Skills Investment Plan, the German ReDI School of Digital Integration and WeGebAU, the Dutch Buurtzorg Model of Care and the Austrian FiT programme. There were two evaluations of the German WeGebAU drawing on a control/comparison group: one experimental design focusing on workers potentially eligible for the measure and one quasi-experimental design focusing on older workers.

Theory-based evaluations: Often, counterfactual impact evaluations are not possible due to practical or ethical issues, in particular when the interventions are complex. In these cases, theory-based evaluations can be used, although they can also be used in combination with counterfactual impact evaluations. Theory-based evaluations focus on the theory behind the programme and make explicit the assumptions that the programme is making about how its objectives are achieved. There are various methods, including process tracing, contribution

analysis and realist evaluation; however, most of them use a theory of change or logic model as a basis. Theory of change can be understood as an articulation of why change is happening by specifying context, inputs, outputs, outcomes and impacts. Only three case study reports mentioned theory-based evaluations and/or presented the theory of change as part of their reporting. These three measures are the Portuguese Academia de Código Bootcamps, and the German Jobstarter plus and ReDI School of Digital Integration. The evaluation of Jobstarter plus included a theory of change for the overall programme that articulated what the programme as a whole was trying to achieve as well as for the individual projects. These were used to develop indicators, outputs, outcomes and impacts, which were then assessed by means of corresponding questionnaires.

Mixed-methods and multistakeholder approach: Nearly half of the measures (48%, *n* = 19) used qualitative and quantitative methods as well as gathering primary data from different people, such as participants and other stakeholders involved in the measure (for instance, delivery staff or employers). For example, the second evaluation of the Austrian FiT programme used a combination of quantitative and qualitative methods, including surveys, focus groups and interviews, and collected data from a range of relevant people such as participants and human resources managers.

Longitudinal approach: Evaluations of 12 measures used a longitudinal approach to data collection. Often, this involved the collection of follow-up data such as employment outcomes of participants ranging from three months to two years after programme completion. The Spanish Green Jobs Programme, for example, collected six-month follow-up data by surveying participants on the impact of the programme, their employment status and further details about their employment as well as their satisfaction with the programme and attribution of outcomes to the programme.

Process and impact evaluation: While some case study evaluations focused on the impact of the measure on participants related to the labour market (percentage in employment at the end of the programme, percentage in employment 12 months after, percentage in employment in relevant jobs, percentage with permanent contracts), fewer also included a process element assessing, for example, the quality of the delivery, its reach and the implementation of the measure. The evaluation of the German Jobstarter plus programme combined a formative evaluation to inform programme delivery with a summative part to assess outcomes and impacts.

Economic evaluation: Ten of the measures included some form of economic evaluation such as cost-effectiveness assessments or cost–benefit analysis (the Austrian FKS, the Portuguese Academia de Código Bootcamps, the German Jobstarter plus, ReDI School of Digital Integration and WeGebAU, the Irish Skillnet, the French Skills Investment Plan, the Latvian Support to attract medical practitioners outside Riga, the Italian Tertiary Technical Education programme and the Dutch Buurtzorg Model of Care). However, there were limitations to most of the economic evaluations, ranging from only consisting of a model to not including all costs or benefits. One of the most robust economic evaluations was of the Dutch Buurtzorg Model of Care. Two cost–benefit analyses compared the economic and social benefits with the associated costs, using a comparison group to strengthen the robustness of the analysis. The Portuguese Academia de Código Bootcamps used a cost-effectiveness analysis comparing the costs of the programme with the typical cost of labour market integration measures.

To conclude, the majority of all measures studied are at the beginning of the evidence journey. There is great diversity within the evaluation approaches, although most commonly they collected monitoring data, often in combination with some qualitative and quantitative evidence. Often, evaluations focused on outputs and/or short-term outcomes, with less emphasis on impact in relation to labour shortages and employment. The largest gaps were in relation to experimental designs and robust economic evaluations. This, in combination with a lack of theory-based evaluations, makes attribution of positive findings to a measure challenging. One of the reasons behind the lack of a clear assessment of the impact of the measures on labour shortages lies not only in poorly developed evaluation approaches, but also in the lack of good data on the precise scale and scope of shortages at a granular level at the outset, as well as the wide range of confounding factors that might have an impact on the development of such shortages.

6 Conclusion

Labour shortages have re-emerged in the aftermath of the COVID-19 pandemic, resuming the pace of growth that marked the decade following the recovery from the global financial crisis. While some of the growth in the level of shortages in the EU is clearly cyclical and driven by the speedy recovery from the pandemic, the data discussed in this report indicate that there are significant structural labour shortages that contribute to current labour supply issues. Labour shortages are caused by a combination of longer-term changes in European labour markets such as digitalisation, the green transition or ageing, and a wide range of contextual factors, which can include low wages, challenging working conditions, and underinvestment in public systems and infrastructure that could assist in overcoming any barriers to labour market entry among inactive groups. In some cases, in addition, the knowledge base and collaboration are insufficient to regularly update and forecast future labour and skills needs, and connections with education and vocational training infrastructure are poor. The need for effective advice and guidance on career choices, and the continued need to target stereotypes and provide good role models, remain evident.

Added to this, labour shortages are also geographically concentrated, with less-developed regions finding it difficult to attract workers, highlighting the importance of boosting mobility and factors that support and encourage such mobility.

The complex array of factors that account for labour shortages makes the phenomenon a challenging and moving target for policy interventions. This report has discussed a broad range of interventions covering sectors and occupations that are currently faced with high labour shortages, underlining the different strategies and approaches used to address them in the context of their main driving factors. The main drivers of labour shortages differ by sector, occupation and region. The key approaches to addressing the phenomenon revolve around increasing the attractiveness of certain sectors and occupations, activating underutilised labour, and better matching supply and demand by enhancing the use of existing labour and retaining labour. Challenging working conditions combined with low pay in some professions are a key factor behind shortages in the health and long-term care sector. While the measures addressing these issues have shown some success, they also demonstrate that further efforts are needed to tackle other contributing contextual factors such as the lack of attractiveness of certain geographical regions. In the ICT sector and with regard to digital skills, skills mismatches and challenges in the regular updating of education and training curricula play a role, which can be addressed with the more structural involvement of social partners and training providers. A similar finding applies to green skills, although market building, the identification of the specific skills needed and the formulation of relevant curricula play an even more significant role here.

The study shows that the most successful interventions share a set of commonalities including a clear assessment of the drivers of shortage, targeting of beneficiaries, a high degree of adaptability and learning, and ongoing monitoring and assessments of outcomes through robust methodologies. It also shows that holistic policy interventions that target the multifaceted nature of shortages can lead to better outcomes at both individual and aggregate levels.

However, the analysis presented in this report can also be read as a cautionary tale. Despite ongoing efforts to address labour shortages, indicators of shortage are on the rise and are expected to continue rising in the medium and long terms. While present policies seek to address some of the underlying drivers of shortage, they appear to be falling short of having an impact on aggregate trends in the labour market. This report highlights the clear need for better evaluation evidence to assess the effectiveness and efficiency of policy measures in affecting indicators of shortage. While some interventions are effective in integrating their target group into shortage sectors, the scale of the measures may be too small or their links with the broader supporting policy framework insufficient to register a more significant impact at aggregate level.

Despite this caveat, the lessons from the case studies do provide some clear indicators of the supporting factors that can contribute to effective policy interventions, and of factors that can act as roadblocks. These lessons can therefore provide a useful input into the policy debate and mutual learning between Member States, while taking on board different contextual factors.

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Annex: Summary of policy measures

Table A1: Overview of 40 analysed measures: country, sector/occupation targeted, temporal scope, budget and lead organisation of the analysed measures

Country	Name of policy measure	Short name	Sector/ occupation targeted	Temporal scope	Average annual budget	Lead organisation
Austria	Women in Crafts and Technology (*Frauen in Handwerk und Technik*, FiT)	FiT	ICT sector[a]	2006–	€22.7 million	Austrian Public Employment Service (AMS)
	klimaaktiv	klimaaktiv	Occupations affected by green transition	2004–	€6.8 million	Ministry for Climate Protection, Environment, Energy, Mobility, Innovation, and Technology
	Skilled worker scholarship (*Fachkräftestipendium*, FKS)	FKS	ICT sector Health and care sector[a]	2013– (with interruption in 2016)	€28 million[b]	AMS
Belgium	Interface3	Interface3	ICT sector	1987–	€2.5 million	Interface3 (non-profit association)
	STEM Action Plan for Flanders (2012–2019) and STEM Agenda for Flanders (2020–2030)	STEM Action Plan and Agenda	ICT sector[a]	2012–2019 (STEM Action Plan) and 2020–2030 (STEM Agenda)	No data	Flemish government
Bulgaria	Monthly remuneration to providers of primary outpatient care for work in areas/regions characterised by adverse working conditions (*месечно заплащане за работа в населени места с регистрирани в ИАМН/РЗИ адрес/и с неблагоприятни условия на работа на изпълнители на първична извънболнична медицинска помощ*)	Adverse working conditions payment for GPs	Health and care sector	2000–	€2.6 million	National Health Insurance Fund and Bulgarian Medical Association
Cyprus	Multi-company training programmes (*Πολυεπιχειρησιακά Προγράμματα Κατάρτισης*)	Multi-company training programmes	Occupations affected by digital transition[a]	1979–	No data	Human Resource Development Authority of Cyprus
	WE-Qualify – Improve Skills and Qualifications in the Building Workforce in Cyprus (*Βελτίωση δεξιοτήτων και προσόντων των τεχνιτών για κατασκευή κτηρίων με αυξημένη ενεργειακή απόδοση*)	WE-Qualify	Occupations affected by green transition	2013–2015	€89,380	Cyprus Energy Agency
Denmark	Technology Pact (*Teknologipagten*)	Technology Pact	Occupations affected by digital transition	2018–2022	€6.1 million	Ministry of Economic Affairs
	Labour Market/Adult Vocational Training (*Arbejdsmarkedsuddannelser*)	AMU	Occupations affected by green transition[a]	Ongoing (over 50 years)	No data	Ministry of Children and Education
Estonia	Choose ICT! (*Vali IT!*)	Vali IT!	ICT sector	2017–	€350,000	Ministry of Economic Affairs and Communications
Finland	Finland's Age of Artificial Intelligence (*Suomen tekoälyaika*)	Age of Artificial Intelligence	Occupations affected by digital transition	2017–2019	No data	Minister for Economic Affairs

Country	Name of policy measure	Short name	Sector/ occupation targeted	Temporal scope	Average annual budget	Lead organisation
France	Grande Ecole du Numérique (GEN)	GEN	ICT sector	2016–	€24 million	Prime Minister
	Skills investment Plan (*Plan d'investissement dans les compétences*, PIC)	Skills Investment Plan	Occupations affected by digital transition	2018–2022	€3 billion	The state at the national level and the regional councils at the regional level
Germany	Concerted Action on Care (*Konzertierte Aktion Pflege*, KAP)	KAP	Health and care sector	2019–2023	€25 million for training €177 million for additional personnel	Federal ministries of health, of labour and social affairs, and of family affairs, senior citizens and youth
	Integration through Qualification (*Integration durch Qualifizierung*)	IQ	Health and care sector[a]	2005–	€70 million (for whole measure)	Federal Ministry for Migration and Refugees, and the regional Integration through Qualification networks
	ReDI School of Digital Integration	ReDI School of Digital Integration	ICT sector	2016–	€2.1 million	ReDI School of Digital Integration
	Jobstarter plus	Jobstarter plus	Occupations affected by digital transition[a]	2014– (expected to finish in 2023)	€13 million	Federal Institute for Vocational Education and Training
	Further training for low-qualified people and older employees in enterprises (*Weiterbildung Geringqualifizierter und beschäftigter älterer Arbeitnehmer in Unternehmen*, WeGebAU)	WeGebAU	Health and care sector[a]	2007–2018[c]	€200 million[d]	Federal Employment Agency
Greece	Digital Marketing Vocational Training Programme (*Πρόγραμμα Επαγγελματικής Κατάρτισης «Ενίσχυση Ψηφιακών Δεξιοτήτων – Ψηφιακό Μάρκετινγκ»*)	Digital Marketing Programme	Occupations affected by digital transition	2020–	No data	Greek Manpower Employment Organisation
	Grow Greece with Google	Grow with Google	Occupations affected by digital transition	No data	No data	No data
Ireland	Skillnet Ireland	Skillnet	ICT sector[a]	1999–	€29.5 million	Skillnet (government-backed business support agency of the Government of Ireland)
	Just Transition Plan (a component of the national Climate Action Plan)	Just Transition Plan	Occupations affected by green transition	2019–	No data	Department of the Environment, Climate and Communications
Italy	Growing in Digital (*Crescere in Digitale*)	Growing in Digital	Occupations affected by digital transition	2015– (expected to finish in 2023)	No data	National Agency for Labour Policies of the Italian Ministry of Labour and Social Policies
	Tertiary Technical Education (*Istituti Tecnici Superiori*)	Tertiary Technical Education	Occupations affected by digital transition	2010–	No data	Participatory Foundation
Latvia	Support for attracting medical personnel to rural regions	Support to attract medical practitioners outside Riga	Health and care sector	2017– (expected to finish in 2023)	€2.1 million	Ministry of Health
	Information technology training for small and micro enterprises to enhance their competitiveness (Project I)	LITKA project I	ICT sector	2012–2015	€450,000	Latvian Information and Communication Technology Association (LITKA)
	Training for small and micro enterprises for the development of innovation and digital technologies (Project II)	LITKA project II	ICT sector	2015–2023	€345,250	LITKA

Country	Name of policy measure	Short name	Sector/ occupation targeted	Temporal scope	Average annual budget	Lead organisation
Luxembourg	Luxembourg Digital Skills Bridge	Digital Skills Bridge	Occupations affected by digital transition	2018–2019	No data	Public Employment Service of Luxembourg
Netherlands	Health Workforce Planning (*Capaciteitsplanning in de Zorg*)	Health Workforce Planning	Health and care sector	1999–	No data	Advisory Committee on Medical Manpower Planning
	Buurtzorg Model of Care	Buurtzorg Model of Care	Health and care sector	2006–	No data	Buurtzorg teams, which consist of self-steering neighbourhood-based generalist working nurse teams, which provide care to independently living clients
Poland	IT for SHE	IT for SHE	ICT sector	2017–	No data	Perspektywy Educational Foundation
Portugal	Code For All Coding Bootcamps (Academia de Código Bootcamps)	Academia de Código Bootcamps	ICT sector	2017–2020	€180,875	Code For All
Romania	2018 increase in wages for doctors and other medical professionals (*Legea cadru nr. 153/2017 privind salarizarea personalului plătit din fonduri publice*)	2018 wage increase	Health and care sector	2018	No data	Government of Romania
Slovakia	You Too in IT (*Aj Ty v IT*)	You Too in IT	Occupations affected by digital transition	2012–	Approximately €150,000 in 2020	Aj Ty v IT NGO
Slovenia	Framework Programme for the Transition to a Green Economy (OPZG) with the Action plan of OPZG activities (ANi OPZG) and the Plan of activities conducted by ministries and government services (NAMVS) 2015–2016 (*Okvirni program za prehod v zeleno gospodarstvo – OPZG z Akcijskim načrtom izvajanja OPZG (ANi OPZG) in Načrtom aktivnosti ministrstev in vladnih služb (NAMVS) 2015–2016)*	Programme for Transition to Green Economy	Occupations affected by green transition	2015– (programme only specifies actions for 2015–2016, but framework has no specific time limit)	No data	Government of Slovenia, Employment Service of Slovenia
Spain	Comprehensive Care Programme for the Sick Doctor (*Programa de Atención Integral al Médico Enfermo*, PAIME)	PAIME	Health and care sector	1998–	No data (only some regional-level information available)	Foundation for Social Protection of the Spanish Association of Medical Associations
	Green Jobs Programme (*Programa Empleaverde*)	Green Jobs Programme	Occupations affected by green transition	2007–	€6.7 million	Biodiversity Foundation
Sweden	National digitalisation strategy for the school system (*Nationell digitaliseringsstrategi för skolväsendet*)	National Digitalisation Strategy for the School System	Occupations affected by digital transition	2017–2022	No data	National Board for Education
	Fast Track for Newly Arrived Immigrants (*Snabbspår för nyanlända*)	Fast Track	Health and care sector[a]	2015–	No data	Swedish Public Employment Service

Notes: *[a] These sectors/occupations are among a broader range of sectors targeted. This means that the budget data provided can cover a broader measure. [b] For 2016 cohort – could include training lasting more than 1 year. [c] Replaced by broader follow-up programme entitled Weiter.Bildung developed on the new legislative basis of the Skills Development Opportunities Act 2019 (Qualifizierungschancengesetz). [d] Annual funding for the whole programme, not limited to training for the health and care sectors. Between 2007 and 2018 around 30% of supported training was in the non-medical healthcare, beauty and wellness sector, elderly care and medical technology/engineering.*

Source: *Authors*

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As economies begin to recover from the COVID-19 pandemic, labour shortages are becoming increasingly evident despite the impact of the war in Ukraine on energy and commodity prices. These include shortages exacerbated by the crisis in some sectors and professions where they had been endemic for some time. This report looks at measures implemented at national level to tackle labour shortages in the health, care, and information and communication technology sectors, as well as those arising from the twin green and digital transition. It assesses what measures are effective and explores the contextual factors supporting or hindering effective policy implementation and outcomes.

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