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# Future skills supply and demand in Europe

## Forecast 2012

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# Foreword

The future is, by definition, uncertain. The future of the labour market, which is influenced by factors which individuals and countries cannot control, is particularly difficult to predict.

However, the future is not a black hole. Realistic assumptions can be made to provide insights on what the future, including the future labour market, may look like. Decisions made today will shape that future and forecasts can, therefore, be particularly valuable in helping to decide the right thing to do.

In recent years, with support from the European Commission and various European experts, Cedefop has built up considerable expertise in forecasting skill supply and demand, and future shape and structure of the European labour market. The forecasts identify major economic and sociodemographic trends and examine their implications for labour market sectors, occupations and qualifications.

This report analyses results of Cedefop's latest forecasts up to 2020. They show that, despite the current economic gloom, the future is not necessarily bleak. Europe is expected to see a welcome return to job growth in the years up to 2020. As this growth is about to be faster than increase of labour supply, the European Union should reach its target of raising the employment rate for 20 to 64 year-olds to 75%. By then, Europe will also have the most highly-qualified labour force in its history. This is particularly important as jobs are becoming more skill-intensive at all levels. As routine tasks are increasingly carried out by technology rather than people, there will be a greater need for skills such as independent problem-solving, planning, organisation and communication, even in elementary occupations.

The path to the future is, however, rarely smooth. Weak employment demand due to the current economic downturn means that, although people are becoming better qualified, some may not find jobs in line with their expectations and qualifications in the short term. However, in the long term, skills will be a driver for Europe's competitiveness and will be a source of future prosperity.

Cedefop's latest forecast is more sophisticated than earlier forecasts and includes indicators of skill imbalances that can act as early warning signals for potential mismatches in occupations, overqualification or recruitment difficulties. It is hoped that the insights provided by Cedefop's skill demand and supply forecasts will help policy-makers and individuals to take informed decisions on their and our futures.

Christian F. Lettmayr
*Acting Director*

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# Executive summary

Making the right decision is often difficult. In the labour market individuals need to choose careers, enterprises have to decide about investment and policy-makers have to consider how to create the best conditions for job growth.

The financial crisis that emerged in 2008 has, in 2012, become a sovereign debt crisis, heightening uncertainty about Europe's economic future. This has added significantly to the difficulties of decision-making and reduced significantly the margin for error. In such circumstances, reliable and relevant information about possible future developments can be very helpful.

Cedefop's skill demand and supply forecasts aim to provide evidence on future labour market developments to help to make informed decisions. The forecasts do not seek to provide precise numbers of supply and demand for particular types of jobs. Rather, the forecasts identify major economic and socio-demographic trends and examine their implications for labour market sectors, occupations and education and training systems.

The main findings of Cedefop's latest skill demand and supply forecast for the European Union ([1]) (EU) for 2010-20 (Box a), indicate that although the economic conditions will determine only a modest increase in job openings, current trends, including a shift to more skill-intensive jobs, a demand for people to be better qualified and more jobs in services, will continue.

The forecasts are based on several assumptions, which take into account global economic developments up to October 2011 and the latest Eurostat population projections ([2]). Based on the European Commission's short-term macroeconomic projections ([3]), up to 2020, a modest recovery is forecast for the European economy and labour market, which will see job growth in all Member States to varying degrees. The forecasts also assume a return of investment and consumer confidence, economic growth outside the EU and continued fiscal consolidation in Member States.

([1]) The forecast covers the 27 EU Member States plus Norway and Switzerland referred to as EU-27+.

([2]) Assumptions and results have been validated by national experts.

([3]) For more information see: http://ec.europa.eu/economy_finance/eu/forecasts/index_en.htm.

Box a **Skill supply and demand forecast for 2020: main findings**

The Cedefop forecast indicates that in the period up to 2020:

- there will be around 83 million job opportunities due to a modest net increase in employment of around eight million new jobs (expansion demand) and around 75 million jobs that will need to be filled as people retire or leave the workforce (replacement demand);
- there will be job openings in all types of occupations, but most new jobs will be at the higher and lower end of the job spectrum ([a]) bringing a risk of job polarisation;
- most job openings will be in services, but due to replacement demand there will also be significant numbers of job opportunities in manufacturing, crafts and agriculture;
- the trend towards more skill-intensive jobs at all levels will continue and many traditional manual or routine jobs will decline;
- more than 80% of people having at least medium-level qualifications;
- owing to weak employment growth, the supply of people with high-level qualifications will exceed the numbers of jobs requiring that level of qualification and may lead to over-qualification in the short term.

([a]) Based on the international standard classification of occupations (ISCO).

## Skill demand trends

Between 2008 and 2010, Europe lost around 5.5 million jobs due to the economic slowdown (Figure a) ([4]). Although substantial, this is less than initially feared as EU Member States and social partners introduced policy measures (including support for short-time working arrangements) to avoid job losses.

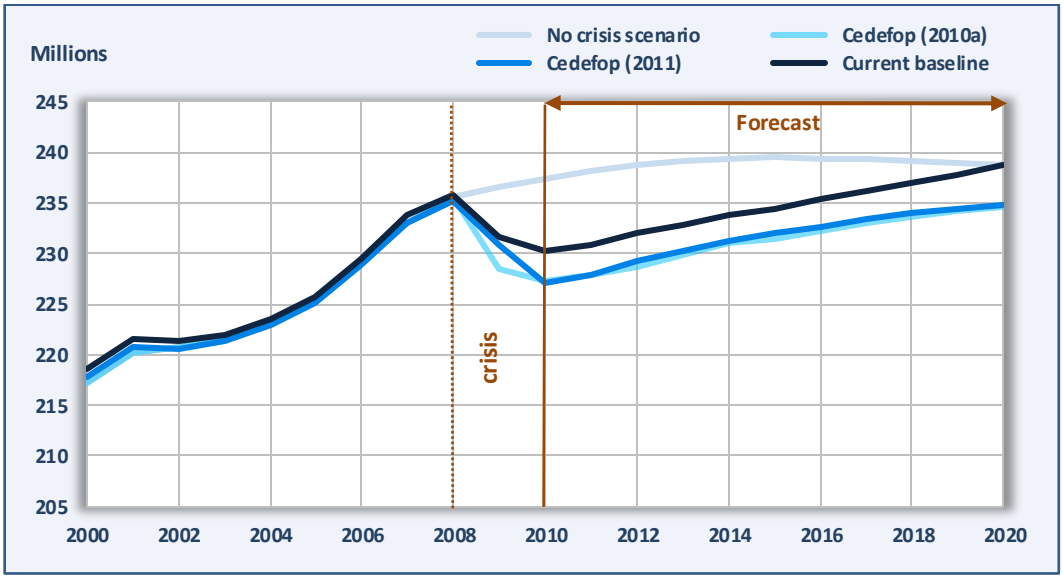
The forecast is that there will be some 83 million job opportunities in EU-27+, including some eight million newly created jobs, but nearly 10 times more job openings (around 75 million) will arise due to the need to fill the jobs of people leaving the workforce.

The trend towards more service-oriented economies will continue and most new job growth will be in the service sector (Figure b). Although, generally, the financial crisis accelerated this trend, some countries have seen their manufacturing sectors expand or stabilise as they benefited from a relocation of

([4]) As a basis for this comparison (no crisis scenario) we have used the forecast published in 2008 (Cedefop, 2008) when no signs of the crisis were apparent. The other two forecasts produced in following years (Cedefop, 2010a; 2011a) reflected the crisis and expected deep decline in employment. The current baseline refers to the scenario where decline between 2008 and 2010 is based on actual data provided by Eurostat.

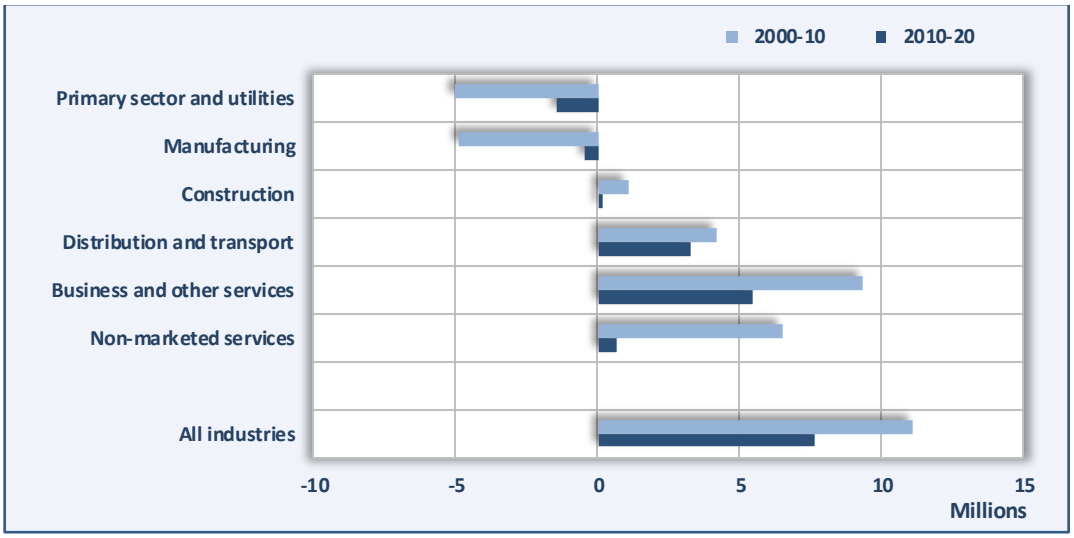
production capacity, notably from western to central and eastern EU Member States. This has had the added benefit of keeping manufacturing in the EU rather than it moving, for example, to Asia, and this has slowed down job losses in this sector.

Figure a **Past and future employment prospects, EU-27+**




*Source*: Cedefop (based on Cambridge Econometrics estimates).

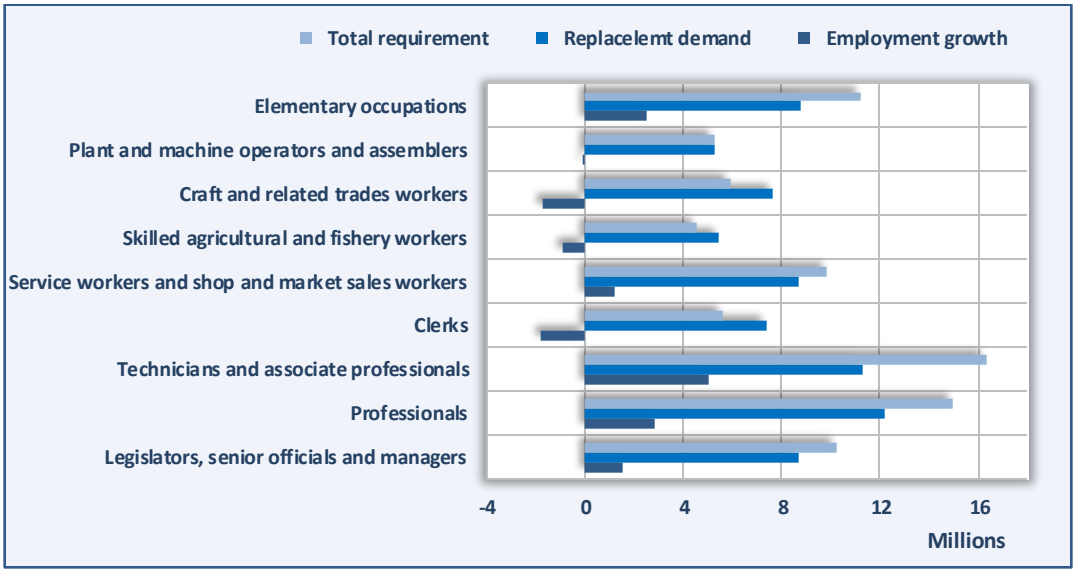
Figure b **Past and likely future sectoral employment change, 2000-10 and 2012-20, EU-27+**




*Source*: Cedefop (IER estimates).

Sector developments will mirror trends in occupational growth. According to the demand forecast, there will be job openings for all occupations, even those whose employment share has been in long-term decline, such as craft and related trade workers (Figure c).

Figure c **Total job opportunities by occupational group, 2012-20, EU-27+**




NB: Job openings are the sum of expansion and replacement demand.
*Source*: Cedefop (IER estimates).

Total numbers of job openings will be positive due to replacement demand, the need to replace people leaving the labour force, for example due to retirement.

However, results indicate some risk of job polarisation as the new jobs will be created mostly on the top or bottom of the job spectrum than equally distributed across. Table a shows the five occupational groups most in demand in the period up to 2020. These groups account for around 90% of the new jobs forecast and around 40% of total job opportunities.

Despite signs of polarisation of job growth, most jobs will require medium-level qualifications (including many vocational qualifications). Jobs at this level will continue to employ around half of Europe's labour force.

At all skill levels, most jobs in demand will be characterised by non-routine tasks which are not easily replaced by technology or organisational change. The link between skill level and routine is not direct. Low-skill production line manufacturing jobs can be routine, but so too are many skilled jobs, including some craft and clerical ones. Some elementary occupations, such as personal

care services, are non-routine and relatively unaffected by technological or organisational change.

Table a **Top five occupations most in demand up to 2020, EU_27+**

*(millions)*

| ISCO occupation | Expansion demand | Replacement demand | Total job opportunities | Share of qualification (%) | | |
|---|---|---|---|---|---|---|
| | | | | High | Medium | Low |
| 34 Other associate professionals | 2.9 | 5.8 | 8.7 | 44.9 | 48.0 | 7.1 |
| 91 Sales and services elementary occupations | 1.0 | 6.2 | 7.2 | 11.1 | 53.9 | 35.1 |
| 51 Personal and protective services workers | 0.5 | 5.6 | 6.1 | 17.9 | 61.8 | 20.3 |
| 24 Other professionals | 2.0 | 4.0 | 6.0 | 77.8 | 19.9 | 2.4 |
| 12 Corporate managers | 1.0 | 4.1 | 5.1 | 62.2 | 31.8 | 5.9 |

*Source*: Cedefop.

Trends identified by the quantitative forecast are supported by a qualitative analysis, which separates structural from cyclical economic trends. Table b shows the sectors predicted to grow or decline most strongly in the years up to 2020 and indicates the level of uncertainty that growth or decline will occur depending on the general economic situation.

Sectors expected to expand irrespective of economic growth rates and demand levels are in the top half of the right-hand column. Sectors in the left-hand column are more sensitive to the business cycle and external factors, such as policy measures (environment legislation) or external shocks (a steep rise in oil prices). Much of the retail sector comprises supermarkets and retail stores with steady business, whereas the likelihood of reversing the long-term decline in agriculture is low. High growth in the car industry depends on a return to sustainable economic growth. The loss in jobs from manufacturing should slow down considerably in the years to come.

Structural change within and between sectors is expected to be slower, compared to the last decade, but its extent and related skill demand varies both across and within Member States. Economic recovery in some newer Member States is supported by specialisation in production and assembly activities, resulting in a relative concentration of medium-skilled jobs. A comparatively highly-qualified workforce, lower labour costs and sufficiently improved physical infrastructure have enabled some Member States to remain competitive in several manufacturing industries. Job losses in manufacturing due to relocation outside the EU have been fewer than expected. Numbers of high-skilled jobs

have increased across all Member States. Services including tourism, health care and IT are still expected to provide most job growth in the years up to 2020, but at a slightly slower rate, partly due to austerity measures and cutbacks in public and private spending and investment.

Table b **Sectors – gowth and uncertainty of this growth**

| Growth rate 2010–20 | Uncertainty about trend in growth: High | Uncertainty about trend in growth: Low |
|---|---|---|
| High | • Pharmaceuticals<br>• Mechanical engineering<br>• Automotive<br>• Construction<br>• Distribution<br>• Hotels and catering<br>• Land transport, etc.<br>• Air transport<br>• Insurance<br>• Education<br>• Health and social work | • Manufacturing (not elsewhere classified)<br>• Water supply<br>• Retailing<br>• Water transport<br>• Communications<br>• Banking and finance<br>• Computing services<br>• Professional services<br>• Other business services<br>• Miscellaneous services |
| Low | • Oil and gas, etc.<br>• Food, drink and tobacco<br>• Wood and paper<br>• Printing and publishing<br>• Chemicals (not elsewhere classified)<br>• Rubber and plastics<br>• Non-metallic mineral product<br>• Basic metals<br>• Electrical engineering and instruments<br>• Electricity | • Agriculture, etc.<br>• Coal<br>• Other mining<br>• Textiles, clothing and leather<br>• Manufactured fuels<br>• Metal goods<br>• Electronics<br>• Other transport equipment<br>• Gas supply<br>• Public administration and defence |

NB: Sectors are not listed in any order of priority.
*Source*: Cedefop (based on Leney and Colombo, 2012).

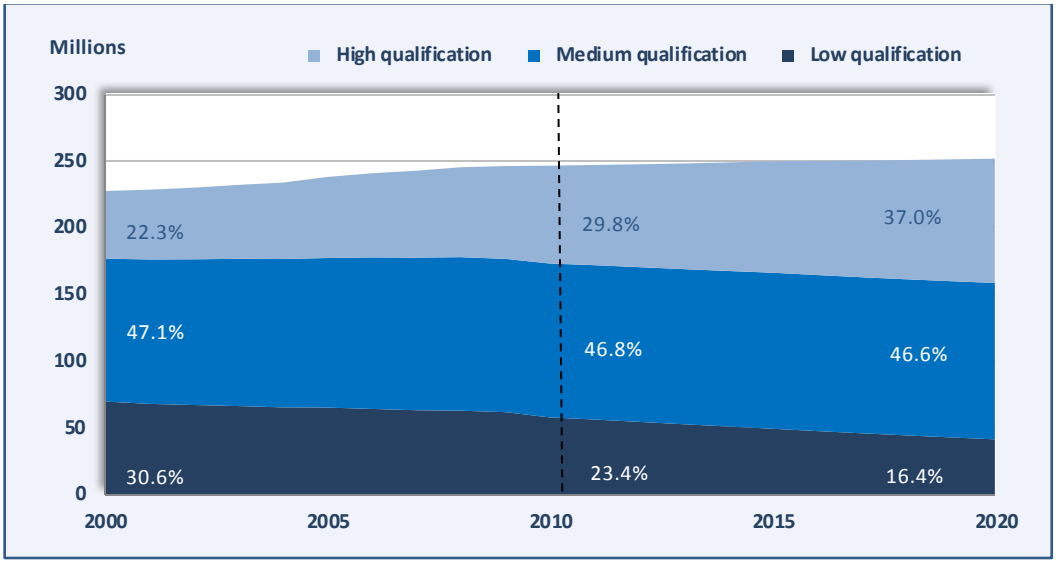
## Skill supply trends

Types and levels of qualifications in the labour force vary between Member States. There are only limited signs of convergence, reflecting different national education and training traditions, economic structures and skill demand. Overall in Europe, numbers of people with medium and high-level qualifications will continue to rise (Figure d), as, generally, young people with higher qualifications will replace older workers who retire and who had less opportunity to acquire formal qualifications.

The share of people with high-level qualifications should rise to more than a third of the labour force. People with medium-level qualifications will continue to account for about half. A higher proportion of women are obtaining high-level qualifications than men. At professional level, more and more women are working

in several traditionally male-dominated sectors. Young people with low or no qualifications will find it increasingly difficult to get a good job.

Figure d **Labour force by level of qualification, 2000-20, EU-27+**




*Source*: Cedefop (IER estimates).

Mobility within, immigration into and people moving to live outside the EU influence the labour force's size and skill composition. This, in turn, can influence skill demand and supply. Cedefop's analysis tends to indicate there is no significant negative impact (or 'brain drain') due to people leaving one Member State to work in another. In effect, most Europeans prefer not to move to find a job in another Member State or outside the EU, even though they have the required qualifications.

## Matching skill demand and supply

If the forecast assumptions ([5]) prove correct, then the EU will probably meet its target of a 75% employment rate for people aged between 20 and 64 in 2020 ([6]).

However, the forecasts also suggest that despite current high levels of unemployment, there are still some signs of skill shortages. The most significant shortages are in occupations where workers need highly specific qualifications

([5]) The main assumptions affecting this number are expected 0.3% growth of employment and stagnation (about 0% growth) of labour force.

([6]) Europe 2020 strategy http://ec.europa.eu/europe2020/index_en.htm.

such as life science and health-associate professionals and teaching-associate professionals. But there is also evidence pointing to shortages in sales, services and some elementary occupations.

To gain insight into future skill imbalances, Cedefop developed an indicator of possible difficulties in recruiting for occupations. The indicator looks at the likelihood of a job being filled in the future by someone with the same qualification level required today. In general, it describes the probability that the same qualification mix (share of high, medium and low qualified) in the occupation will remain. Based on forecasting results this share is more likely to remain stable in the higher-level occupations (such as associate professionals) than in the lower one (such as plant and machine operators). It appears that, in the near future, there is likely to be little difficulty in finding recruits with the appropriate qualification level to fill jobs for highly-qualified workers. In contrast, sales, services and elementary occupations may face very high difficulties. This depends on the speed of economic recovery and other factors, such as quality of working conditions (which may be poor and make these occupations unattractive) and the size of replacement demand.

According to the forecast, the economic slowdown has constrained economic growth and skill demand. As a result, initially, supply of higher qualifications will rise faster than demand for them. Weak employment demand is currently increasing competition for the jobs available. Consequently, people may be more willing to accept jobs for which they are overqualified and, occasionally, part-time work or other less favourable conditions, including lower wages. Under these conditions, highly-qualified people sometimes displace lower-skilled people from jobs.

If temporary, overqualification is not necessarily a problem. Better qualified people have a better chance of keeping a job and, once in employment, they may be more innovative and change the nature of the job they are doing. Highly-skilled people may also find it easier to transfer skills gained in one sector to a job in another. Evidence (Cedefop, 2010; Cedefop, forthcoming (b)) however, show that overqualification tends to persist. It may lower productivity as people become discouraged and frustrated in their jobs and as their skills, by being unused or undeveloped, become obsolete.

Skill mismatch, however, is more than a discrepancy between labour market needs and particular skill levels as measured by qualifications. It is often about lack of the ‘right’ skills in a job and the mismatch between the fields people study and those the labour market requires.

Employers point to shortages linked to too few young people studying science, technology, engineering or mathematics and report on skill shortages in

specific professions. Ahthough more and more young people currently leave education with a university degree or equivalent, it is difficult to plan for the specialisations and wider skills they will need. The search for the 'right' skills is, to some extent, reflected in increasing numbers of students opting for upper-secondary, pre-tertiary and tertiary-level vocational qualifications.

The labour market is not static and the 'right' skills change over time and according to places. Macro level skill forecasts have limits and more detailed sector, national or regional skill analyses are essential to improve the match between demand and supply. Partnerships of various stakeholders, including education and training providers, social partners and employment services are necessary to improve labour market intelligence and coordination. This can be costly, but so too is skill mismatch. Better vocational guidance and counselling services can help people make informed choices about their careers and the education and training they need. They can also help enterprises to plan and develop the skills they require.

## Europe's skill challenge: getting the best out of a highly-qualified workforce

Cedefop's demand and supply forecasts show considerable risk for skill mismatch in Europe in 2020. With rapid technological progress and lags in the education and training process, skill imbalances between sectors and in new or emerging occupations are likely to arise. At the same time, micro level skill mismatches are an inevitable consequence of the imperfect nature of the job search process in the labour market. This is likely to lead to a rapid increase in people with high-level qualifications employed in jobs traditionally requiring lower skill level, certainly in the short term, and a sharp fall in jobs for people with low or no qualifications. At the same time, disproportions in actual and more specialised skills even within the same field of study are considered more of a problem by employers (Cedefop, forthcoming (b)).

Implications of the forecast's findings go beyond the need to improve forecasting techniques and obtaining a better match between skill supply and the right jobs, even though these are important.

The key policy message of the forecasts is the need to consider how to use the skill potential of the EU's labour force to the full. As qualification levels of Europe's workforce are increasing – by 2020 more than a third of the workforce will have high-level university or equivalent qualifications – the challenge is to prevent high-level skills from going to waste. Employing, maintaining and developing them is important for Europe's competitiveness. But so is utilising

them properly via creation of high-skilled jobs. Europe needs to invest in high skill-high productivity jobs rather than regress to cost-cutting low productivity strategies (as tends to happen today due to the crisis).

These questions concern not only how to stimulate job growth and create skill demand, but also how job design in organisations can encourage people to use the full range of their skills in any job, how to create supportive learning and working cultures that provide opportunities for employees to develop and broaden their skills to keep up with change and demand for skills such as problem-solving, information and communication, or green skills.

Finally, despite the clear trend towards more skill-intensive jobs, there is no guarantee that qualification levels will continue to rise. Skill supply as measured by qualifications is driven by demography and labour market trends combining with individual decisions about how much time and money (in terms of tuition fees or foregone income, or, as is increasingly the case, both) to invest in education and training. If investment in education and training does not pay off as expected – financially but also in terms of job and life satisfaction – people may become disappointed and disillusioned as their skills go to waste.

Consequently, despite some signs of skill oversupply in the short term, there is a need to maintain, or even increase investment in education and training by governments, enterprises and individuals, despite the current pressures of austerity. It is mostly adult workers who will need to cope with changes in the future and who need to be kept in the labour force. Opportunities need to be provided to enable them to learn and qualify for different jobs at any stage of working life. If these opportunities are not forthcoming the risk of low-qualified people today becoming long-term unemployed is increasing.

A highly-qualified and well-trained labour force is one of, if not the most important factor for European competitiveness. That the EU is well on track to reach its targets to raise qualification levels of the workforce is good news and important for economic recovery. However, given the current economic situation, further efforts are needed to reduce mismatch and to ensure that Europe gets the best out of the most highly-qualified and most talented workforce in its history.

# Introduction

European economies face considerable difficulties due to the 2008 financial crisis and the persistent economic slowdown that has followed, adding to uncertainty about the future. Europe faces several important challenges affecting its future labour marke: an ageing society requires more effective use of the labour force as fewer young people replace those who retire; production processes are becoming increasingly sophisticated; public budgets are being fiscally consolidated; education and training systems face tough financial constraints.

The importance of good labour market intelligence to help tackle current economic problems has been recognised at the highest levels. To improve Europe's capacity to anticipate changes on the European labour market Cedefop has been asked (Council of the EU, 2010) to forecast European trends in skill demand and supply every two years.

Cedefop's earlier work ([7]) laid a firm foundation for regular skill forecasting, developing a conceptual framework and model to produce internationally comparable results of skill demand and supply.

This latest demand and supply forecasts combine quantitative and qualitative analyses and cover all European Union (EU) Member States, plus Norway and Switzerland (referred to in the text as EU-27+).

Using the latest information, new and improved data, the forecasting model has been updated to assess prospects for the period up to 2020, considering the impact of the financial crisis and subsequent economic downturn. They also introduce imbalance indicators that can act as early warning signals for potential mismatches in occupations, overskilling or recruitment difficulties.

Any attempt to understand and explain interaction of skills on the labour market opens new horizons. There are limitations to the data and methodology and the economic situation, including labour and skill market, is constantly changing. This is a caveat of any forecast exercise.

Pan-European forecasts are not meant to substitute national ones, but aim to complement them by providing a broad and consistent outlook for Europe as a whole. European forecasts provide a framework in which more detailed national analyses can be compared.

([7]) Cedefop's skill demand forecast (Cedefop, 2008); skill supply forecast (Cedefop, 2009) and the first pan-European forecast of skill supply and demand (Cedefop, 2010a).

The forecasts' results are just the starting point. To support decision-making, they must be widely disseminated and debated. Under the Europe 2020 strategy and the agenda for new skills and jobs ([8]), the European Commission will produce an EU skills panorama to improve transparency for jobseekers, workers, companies and/or public institutions. Cedefop's skill demand and supply forecasts will be one of its key building blocks.

Cedefop's forecasts do not aim to give precise answers about how many people with certain qualifications are needed for certain occupations in a particular sector at a certain time. The forecasts are not manpower planning tools. The aim is to provide information on future trends in sectors and occupations to support decisions by policy-makers, businesses, education and training providers and individuals.

In the light of this aim, in this publication, Chapter 1 presents the latest skill demand forecast. It sets out the key macroeconomic assumptions and main differences between the latest and earlier forecasts. Combining quantitative and qualitative analyses, the chapter discusses skill demand by sector and occupation and the risk of job polarisation raised by the trends identified. The chapter then looks at trends in skill demand by qualification level, before providing some broad conclusions on the findings.

Chapter 2 presents the latest skill supply forecast. It sets out the assumptions concerning the size and structure of the population and labour force, and briefly discusses the effects of migration. The chapter then analyses skill supply as measured by numbers of people holding different levels of qualifications and closes with some brief conclusions.

Chapter 3 considers the implications of the skill demand and supply forecasts and the imbalances they identify. The chapter looks first at their possible effects on employment levels. It then examines problems of matching skill demand and supply, before concluding with a summary of the nature of the skill challenge Europe faces.

Annexes provide more detail on the methodology and background data. Detailed data used in the forecast are also available online at www.cedefop.europa.eu.

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([8]) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, An agenda for new skills and jobs: A European contribution towards full employment (European Commission, 2010), http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0682:FIN:EN:PDF.

CHAPTER 1.

# Forecast for skill demand

Future skill demand is forecast to be positive for the period 2010-20.

Assuming a moderate economic recovery in EU-27+, employment is expected to rise to around 235 million by 2020, with a total of around 83 million job openings in the same period.

A modest net increase of employment will result from around eight million new jobs (expansion demand) and about 75 million job opportunities arising as people leave the labour market for various reasons (replacement demand). Replacement demand is crucial as its causes are more stable, being less subject to the business cycle (Kriechel, 2012).

Although economic conditions will affect the actual numbers, long-term trends driving skill demand are expected to continue. Most job openings will be in services but the primary and manufacturing sectors will remain extremely important to the European economy and provide significant numbers of job openings due to replacement demand.

There will be job openings for all types of occupations, but more skill-intensive jobs at all levels will continue to grow and many traditional manual or routine clerical jobs will decline. Most new jobs will be at the higher and lower end of the skills spectrum, posing a risk of job polarisation. However, most job openings, owing to the sheer scale of replacement demand (nearly 10 times bigger than expansion demand) will be for jobs requiring medium-level qualifications, many of which are vocational qualifications. Jobs requiring medium-level qualifications will still employ around half EU-27+'s labour force.

This chapter outlines Cedefop's latest medium-term forecast of skill demand in EU-27+ ([9]). It sets out the key macroeconomic assumptions and main differences between the latest and earlier forecasts. Combining quantitative and qualitative analyses, the chapter goes on to discuss skill demand by sector and occupation. After considering the risk of job polarisation, the chapter looks at trends in skill demand by qualification level, before providing some broad conclusions on the findings.

([9]) Skill demand is measured here by numbers employed by occupation and highest qualification held. Strictly speaking, employment levels are the result of interaction of both demand and supply. Demand should also include unfilled vacancies, but at present they are not comprehensively and consistently measured at pan-European level.

## 1.1. Macroeconomic prospects and impact of the economic downturn

Economic conditions determine overall demand for labour and skills. Underlying drivers of change, such as globalisation and technological change are expected to continue the general shift towards employment in services and the knowledge economy. For several European countries the shift from agriculture and other primary industries to the tertiary sector is a key feature.

As a result of the financial crisis and the economic downturn that followed, in 2009, European GDP fell by 4 to 5% and employment demand by around 2%. The sharp fall in investment, particularly in construction, slower growth in business services, along with pressure to reduce public finances that saw public sector job cuts, all contributed to employment in the EU falling, between 2008 and 2010, by about 5.5 million. Another 3.8 million jobs expected to be created over this period (Cedefop, 2008) were also lost.

Consequently, the crisis can be seen as reducing employment overall by some 9.3 million. Although substantial, this was less than feared when the first signs of crisis appeared as Member States and social partners introduced policy measures (including support for short-time working arrangements) to avoid job losses and GDP growth for 2010 turned out to be better than expected (Figure 1).

Using the European Commission's short-term macroeconomic projections ([10]), the new baseline for the latest demand forecast assumes a gradual and modest recovery for the European economy and labour market, with job growth returning to all Member States to varying degrees. The forecasts also assume a return of investment and consumer confidence, economic growth outside the EU and continued fiscal consolidation in Member States.

This seems the most sensible option. Alternative forecasts based either on strong economic growth that no one expects, or on the wholly unpredictable economic consequences of a total or partial break-up of the Eurozone would tell us little at this stage ([11]). Figure 2 compares the new baseline with two previous scenarios presented by Cedefop in the *Skills supply and demand forecast* (Cedefop, 2010a), updated in 2011 (Cedefop, 2011a) and the current baseline. Current baseline expects a bit faster recovery in 2010 but more conservative expectations for the future.

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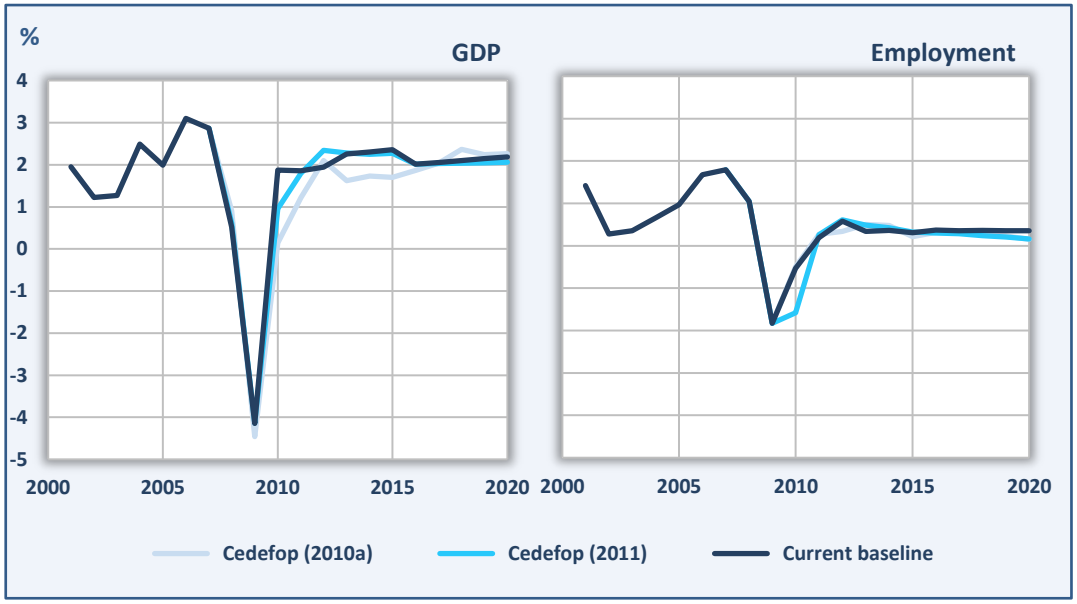
([10]) For more information see: http://ec.europa.eu/economy_finance/eu/forecasts/index_en.htm.

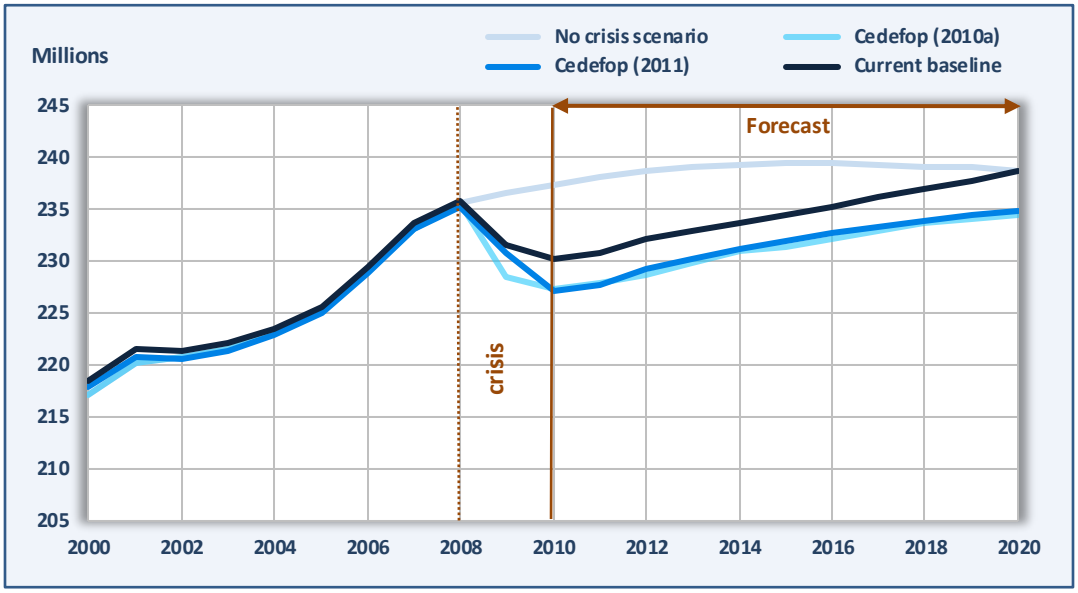
([11]) Although not included, work has been done on two possible scenarios based on loss of confidence and government austerity. More information on the basic economic fundaments of Cedefop's forecast is available in Pollitt and Zhao (2012).

Figure 1 **Past and likely future prospects for GDP and employment growth in different vintages of forecast, EU-27+**




*Source*: Cedefop (Cambridge Econometrics estimates).

Figure 2 **Past and future employment prospects, EU-27+**




*Source*: Cedefop (based on Cambridge Econometrics estimates).

The results also suggest that labour supply was largely unaffected by the crisis (Section 2.1), which implies that another economic downturn, or even recession, could result in a major short-term increase in unemployment, particularly for young people in some Member States.

## 1.2. Skill demand in sectors

Sectoral employment trends are forecast to be similar to those prior to the financial crisis, continuing the long-term shift from the primary sector (especially agriculture) and traditional manufacturing towards services and the knowledge economy.

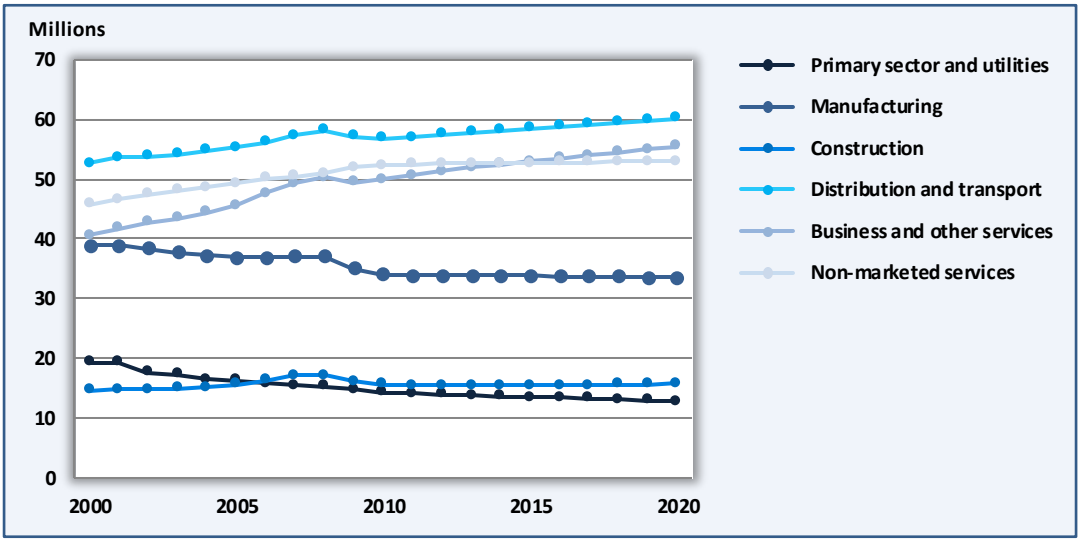
Business and other services should see the highest increase in numbers of new jobs. Employment share will continue to decline in the primary sector and utilities comprising agriculture, fishery, mining and quarrying and network industries (electricity, gas and water) (Figure 3).

Generally, the economic downturn appears to have affected overall employment levels rather than the sectoral structure, but it has caused some discontinuities in sector trends. For example, the trend towards more jobs in construction and in banking and finance were reversed. This trend is expected to recover in the longer term (Wilson, 2012). Public sector employment has also fallen, due to measures to reduce public financial deficits. This trend, however, is expected to continue. The crisis also helped save some jobs in agriculture by stopping people moving to jobs in other sectors and by encouraging some to return to working on the land. Job losses in manufacturing also slowed down as enterprises relocated to newer Member States, rather than outside the EU.

Sectoral change between 2010 and 2020 is expected to be slower than between 2000 and 2010, despite the economic effects of the financial crisis (Figure 4), but the extent of change and related skill demand varies both across and within Member States. For example, in the newer Member States which still have not finished their economic transition and older ones with still a high share of employment in the public sector are expected to reduce this employment more than average. At the same time, some countries which can still offer a comparatively cheaper but highly-skilled labour force (such as Vysegrad countries) can expect stability or even growth of employment in the manufacturing sector.

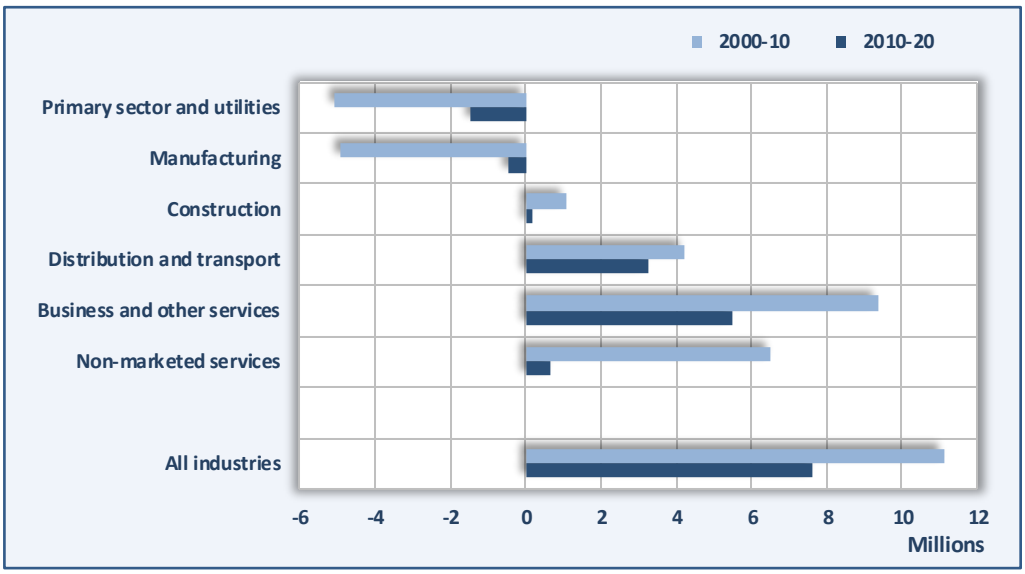
As economic prospects are so uncertain, rather than create different quantitative scenarios, future sectoral development has also been analysed qualitatively, considering future dynamics and their different degrees of uncertainty (Leney and Colombo, 2012).

Figure 3 **Long-term trends in employment by sector, EU-27+**




*Source*: Cedefop (IER estimates).

Figure 4 **Past and likely future sectoral employment change (EU-27+) 2000-10 and 2010-20**




*Source*: Cedefop (IER estimates).

Table 1 shows sectors predicted to grow or decline most strongly in the years up to 2020. Sectors expected to expand irrespective of economic growth rates and demand levels are in the top half of the right-hand column (growth is expected to be high and uncertainty that the growth will occur is low). Sectors in the left-hand column are more sensitive to the business cycle and external factors, such as policy measures, for example environment legislation, or external shocks, such as a steep rise in oil prices.

Table 1 **Sectors – growth and uncertainty of this growth**

| Growth rate 2010–20 | Uncertainty about trend in growth: High | Uncertainty about trend in growth: Low |
|---|---|---|
| High | • Pharmaceuticals<br>• Mechanical engineering<br>• Automotive<br>• Construction<br>• Distribution<br>• Hotels and catering<br>• Land transport, etc.<br>• Air transport<br>• Insurance<br>• Education<br>• Health and social work | • Manufacturing (not elsewhere classified)<br>• Water supply<br>• Retailing<br>• Water transport<br>• Communications<br>• Banking and finance<br>• Computing services<br>• Professional services<br>• Other business services<br>• Miscellaneous services |
| Low | • Oil and gas, etc.<br>• Food, drink and tobacco<br>• Wood and paper<br>• Printing and publishing<br>• Chemicals (not elsewhere classified)<br>• Rubber and plastics<br>• Non-metallic mineral product<br>• Basic metals<br>• Electrical engineering and instruments<br>• Electricity | • Agriculture, etc.<br>• Coal<br>• Other mining<br>• Textiles, clothing and leather<br>• Manufactured fuels<br>• Metal goods<br>• Electronics<br>• Other transport equipment<br>• Gas supply<br>• Public administration and defence |

NB: Sectors are not listed in any order of priority.
*Source*: Cedefop (based on Leney and Colombo, 2012).

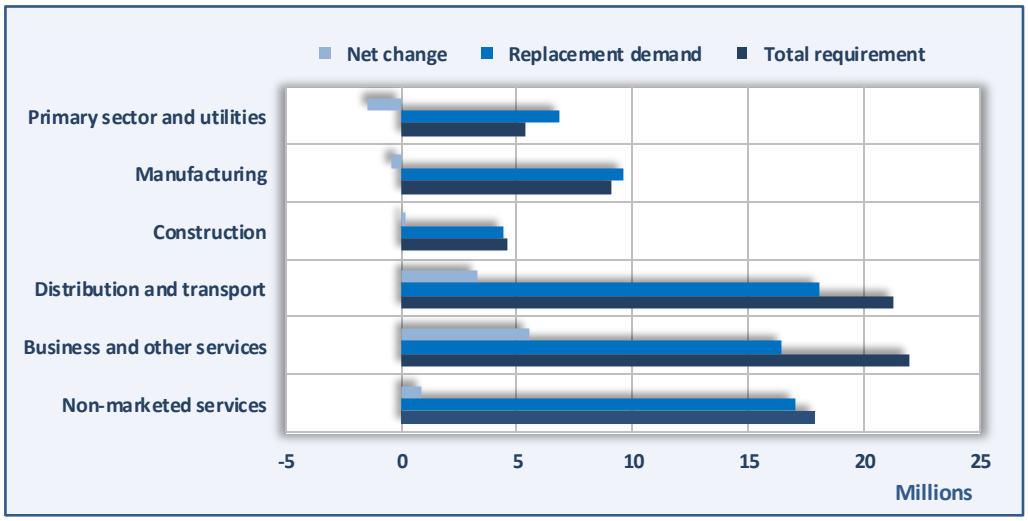
Much of the retail sector comprises supermarkets and retail stores with steady business. It is therefore fairly certain that this sector will grow compared to others (placing it in the top right-hand column). Growth in the automotive sector is expected to be higher than average, but depends on the overall economic situation (people may postpone decisions to buy cars when the economy is weak than when it is growing strongly). This makes the automotive sector highly affected by uncertainty. In contrast, agriculture or the textile industry which experience long-term decline is unlikely to be reversed even if the economy booms. Consequently, agriculture and textiles is in the lower right-hand column. The sectors in the bottom left quadrant represent those which are experiencing relatively low growth compared to others. At the same time, in the case of economic boom this growth can be significantly increased (oil and gas will be more in demand during economic growth) or significantly slowed down in case of further economic problems (in case of further economic slow down sectors such as rubber and plastics, or production of basic metals could be relocated outside the EU).

In terms of how sector developments translate into skill demand, following the long-term trend, most new jobs (expansion demand) will be in services. However, all sectors will have significant numbers of job opportunities owing to replacement demand.

Over the period 2010-20, in EU-27+, business and miscellaneous services, including tourism, cultural and leisure activities, are forecast to create most new jobs, around 5.5 million. In distribution and transport, employment is forecast to grow by more than three million. Employment in non-marketed services ([12]) will grow by just under a million. Increased tension is also possible between needs to improve education and health care, and consolidate public finances.

Employment share in construction should be fairly stable, accounting for about 30-40% of all jobs, but the primary (notably agriculture) and manufacturing sectors are forecast to lose around 1.5 million. Both sectors will remain crucial to the European economy. They will continue to account for substantial numbers of jobs and job openings owing to the size of replacement demand (Figure 5).

Figure 5 **Employment growth and total job openings by broad sectors, EU-27+**




*Source*: Cedefop (IER estimates).

Sector development in EU-27+ is a natural consequence of national developments. Over the period 2010-20, employment share of the primary and manufacturing sectors is expected to decline in all countries, except Hungary (Figure 6). In 2020, Bulgaria and Romania will have the largest primary and manufacturing sectors in terms of employment share, and Luxembourg and the UK the lowest.

([12]) Non-marketed services are those predominantly offered by the public sector.

Figure 6 **Shares of employment by sectors and country**


*Source*: Cedefop.

For construction and transport, employment share is expected to rise in countries such as Bulgaria, Estonia, Spain, Ireland, Cyprus, France, Latvia, Malta, the Netherlands, Poland, Portugal, Romania, Finland and Sweden, reflecting a return of investor and consumer confidence.

Comparing developments in service sector employment reveals some differences between countries.

In eight countries (Belgium, Denmark, France, Luxembourg, the Netherlands, Norway, Sweden and the UK) the services sector will provide more than 50% of employment in 2020. However, despite this overall trend, some countries (such as Ireland, Spain, Cyprus, Latvia, Portugal and Finland) are expected to see a slight decrease in the share in employment in services. This is mostly due to expected reductions in the non-marketed services sector mainly in public administration and defence but also, notably in Ireland and Spain, contractions in their banking and finance industries.

## 1.3. Skill demand by occupation

Skill demand by occupation reflects general economic trends and changes in and between sectors. Currently, skill demand is being influenced by the economic slowdown, the shift towards more service-oriented economies, technological and organisational changes, notably, but not exclusively in the manufacturing sector and relocation of some manufacturing within and outside the EU.

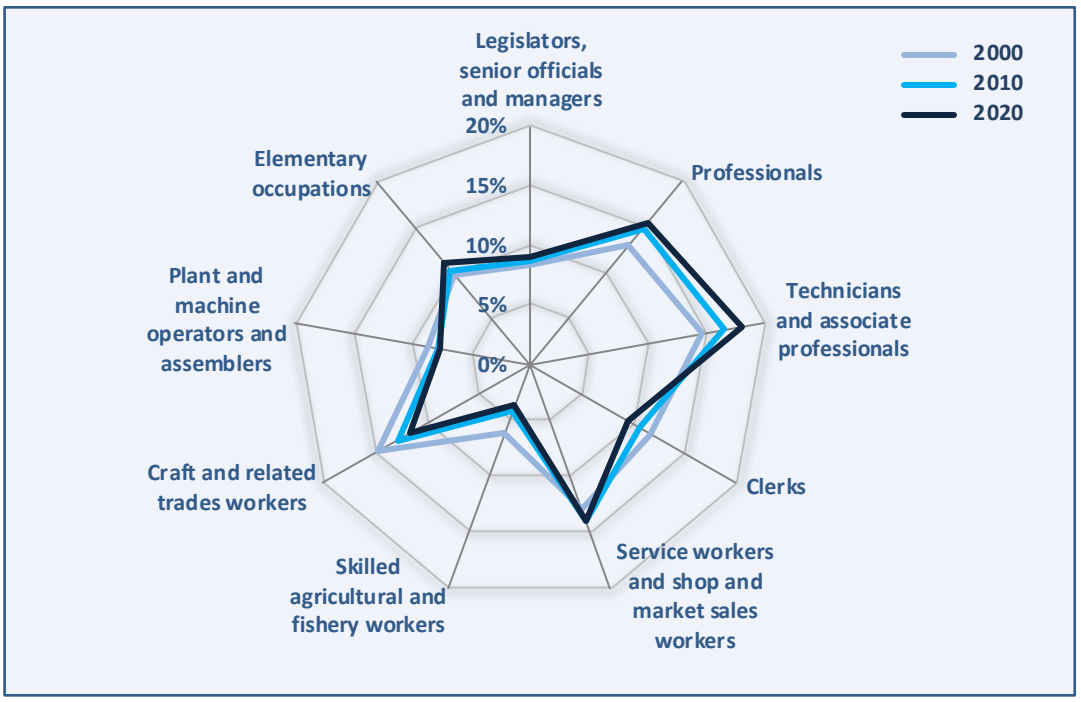
Most recent increases in employment have been concentrated in higher-skill occupations typically requiring formal qualifications such as a university degree. Employment growth (expansion demand) is expected for management, professional and associate professional occupations. Demand for these occupations is expected to be higher than average.

There will also be job growth for many service and sales workers, especially in retail and distribution, as well as for some elementary occupations traditionally requiring little or no formal skills.

In contrast, around 4.5 million jobs requiring traditional manual skills, such as craft and related trade workers, plant and machine operators, skilled agriculture workers and clerks are forecast to be lost up to 2020.

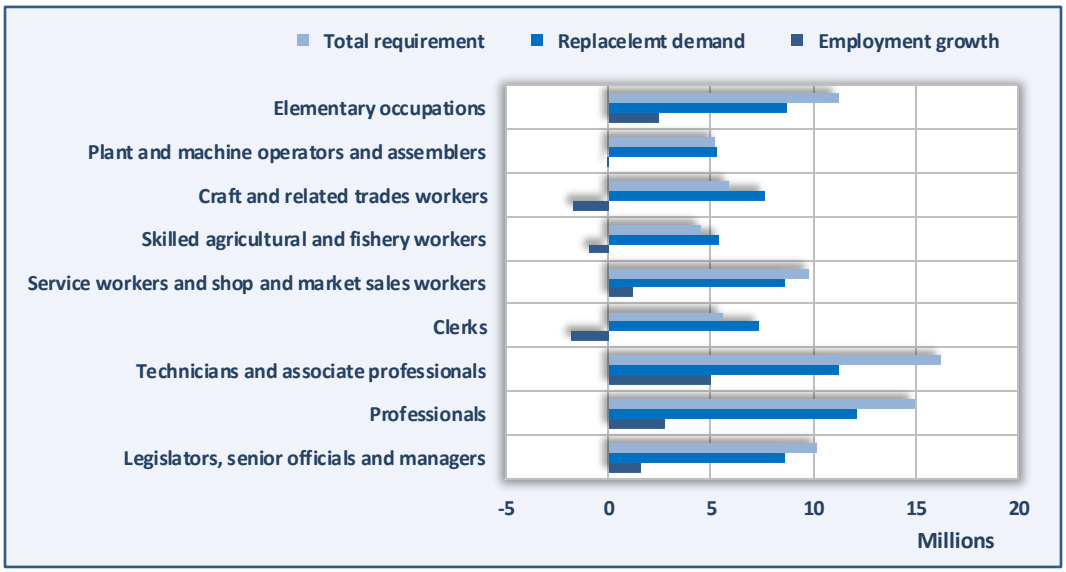
Employment structures in EU-27+ are changing (Figure 7). Technicians and associate professionals will be the most important occupational group in 2020 and will account for around 18.1% of total employment. It will also be the fastest growing as its share of employment is likely to increase by about 1.5% between 2010 and 2020. This group covers highly-skilled occupations such as associate professionals in physical and engineering science, life science and health, teaching, finance and business sectors, as well as public administration. (Kriechel, 2012).

Figure 7 **Changing occupational structure of employment, EU-27+ (%)**



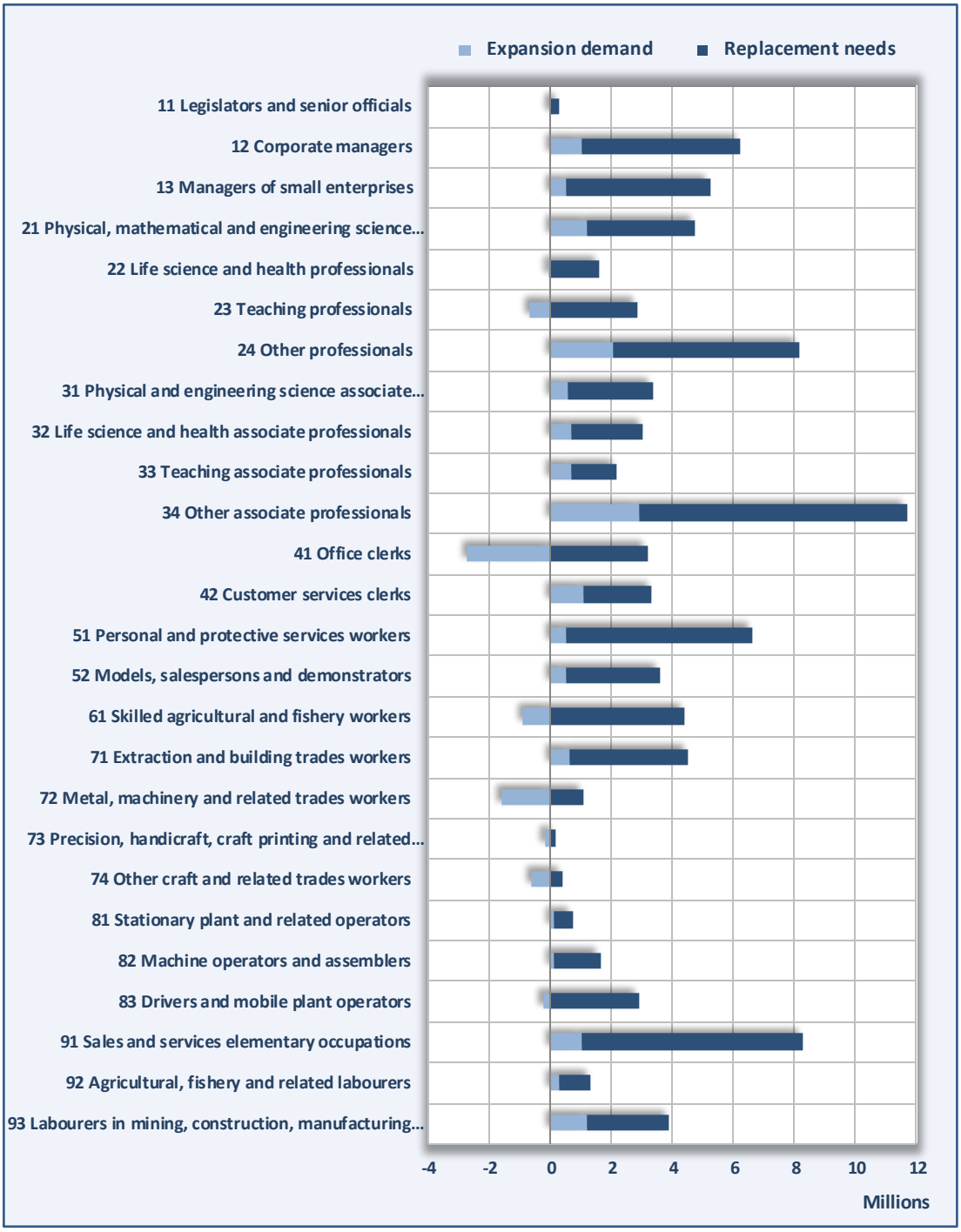

*Source*: Cedefop (based on IER estimates).

Figure 8 **Total job opportunities by occupational group, 2010-20, EU-27+**




NB: Job openings are the sum of expansion and replacement demand.
*Source*: Cedefop (based on IER estimates).

Figure 9 **Employment growth and total job openings by occupation**




*Source*: Cedefop (IER estimates).

Owing to replacement demand, total job openings are forecast to be positive for all major occupational groups between 2010 and 2020 (Figure 8). There are expected to be around 26.5 million job openings, about a third of the total for

occupations which will decline in terms of employment share, for example, clerks, skilled agriculture and fishery workers, craft and related trades workers, plant and machine operators and assemblers.

Figure 9 gives a more detail occupational breakdown of job openings up to 2020, combining expansion and replacement demand ([13]). The figure shows total job openings as the sum of expansion and replacement demand.

Most job opportunities will be in the 'other professionals' (which covers jobs such as business and legal professionals), 'other associate professionals' (which includes finance and sales associate professionals, business services agents, police inspectors and detectives), as well as 'sales and service elementary occupations' (which include street vendors, domestic help) occupational groups.

## 1.4. Risk of job polarisation

The demand forecast's findings show that most job growth will be in higher- and lower-skill occupations with slower growth in occupations requiring medium-level qualifications.

Table 2 shows the five occupational groups most in demand in the period up to 2020. These groups account for around 90% of the eight million new jobs expected to be created and around 40% of the total 83 million job opportunities. The table shows how job creation is polarised, with most job growth being for highly-skilled, or elementary occupations, or jobs in sales traditionally requiring predominantly low-level qualifications.

Table 2 also illustrates the importance of replacement demand. Around 60% of the jobs in the professional and protective service workers occupational group require medium-level qualifications. More than 90% of the job openings for this group are due to replacement demand. Similar for sales, service and elementary occupations where most jobs require medium- or low-level qualifications, around 87% of job openings are due to replacement demand.

Jobs that will be in demand tend to be characterised by non-routine tasks which are not easily replaced by technology or organisational change (Wilson, 2012). Workers, in whatever sector, occupation or qualification level working on largely routine tasks, can be, and most often are, substituted by technology.

([13]) The pilot exercise to provide results for expansion demand at ISCO 3 digit was considered successful and results are available for further scientific examination. The full set of results on this level of disaggregation will be available in spring 2013.

Table 2 **Top five occupations most in demand up to 2020, EU-27+**

*(millions)*

| ISCO occupation | Expansion demand | Replacement demand | Total job opportunities | Share of qualification (%) | | |
|---|---|---|---|---|---|---|
| | | | | High | Medium | Low |
| 34 Other associate professionals | 2.9 | 5.8 | 8.7 | 44.9 | 48.0 | 7.1 |
| 91 Sales and services elementary occupations | 1.0 | 6.2 | 7.2 | 11.1 | 53.9 | 35.1 |
| 51 Personal and protective services workers | 0.5 | 5.6 | 6.1 | 17.9 | 61.8 | 20.3 |
| 24 Other professionals | 2.0 | 4.0 | 6.0 | 77.8 | 19.9 | 2.4 |
| 12 Corporate managers | 1.0 | 4.1 | 5.1 | 62.2 | 31.8 | 5.9 |

*Source*: Cedefop.

This trend is having a strong impact on the demand and skill composition of the labour force. However, there is no direct link between skill level and routine tasks. In manufacturing, several low-skill production-line jobs can be described as routine, but so too are many skilled jobs, including some craft and clerical ones. In contrast, several elementary occupations such as housekeeping, personal care and catering are non-routine and so relatively unaffected by technological change.

To understand this effect, Figure 10 shows the contribution to employment growth at occupation level of the structural and occupational specific components of jobs in that occupational group (Leney and Colombo, 2012).

The occupational specific component captures the growth in jobs generally attributed to organisational change due to technological progress. Medium- and low-skill jobs generally have a larger occupation-specific component. Because of this, for example, the impact of organisational change due to technological progress will result in substantial job losses for clerks. Essentially this means that people currently carrying out routine tasks will be replaced by technology, a trend identified in earlier Cedefop work (Cedefop, 2011b).

The structural component, primarily non-routine or even new tasks resulting from changes in work organisation to increase productivity, however, has a positive effect on job growth for clerks. The overall effect is to reduce the overall number of job losses for clerical occupations.

Job polarisation can also be examined by looking at the uncertainty of future growth. Table 3 shows occupations differentiated by their growth and certainty that the growth will take place.

Occupations in the upper half of the table are expected to grow relatively faster than those in the bottom half. Growth trends of occupations in the left-hand column are less certain to grow than those in the right-hand column.

Figure 10 **Structural and occupation specific component of employment growth, 2010-20**


*Source*: Cedefop (based on IER estimates).

Looking at occupations expected to grow most, the conclusions are similar to those from the quantitative analysis. High growth is expected in occupations requiring high-level qualifications, such as corporate managers, other professionals or other associate professionals. Economic conditions may accelerate or slow down the trend, but are not expected to change it.

Sales and service and elementary occupations, which largely require medium- or low-level qualifications, are expected to grow, but are much more subject to the performance in the economy as a whole. Other occupations such as skilled agricultural and fishery workers are expected to continue their long-term decline.

Table 3 **Occupations – growth and uncertainty**

| Growth rate 2010–20 | Uncertainty about trend in growth: High | Uncertainty about trend in growth: Low |
|---|---|---|
| High | • Physical and engineering science associate professionals<br>• Personal and protective services workers<br>• Stationary plant and related operators<br>• Sales and services elementary occupations | • Legislators and senior officials<br>• Corporate managers<br>• Physical, mathematical and engineering science professionals<br>• Other professionals<br>• Teaching associate professionals<br>• Other associate professionals<br>• Customer services clerks<br>• Models, salespersons and demonstrators<br>• Labourers in mining, construction, manufacturing and transport |
| Low | • Armed forces<br>• Managers of small enterprises<br>• Teaching professionals<br>• Life science and health associate professionals<br>• Extraction and building trades workers<br>• Metal, machinery and related trades workers<br>• Other craft and related trades workers<br>• Machine operators and assemblers<br>• Drivers and mobile plant operators | • Life science and health professionals<br>• Office clerks<br>• Skilled agricultural and fishery workers<br>• Precision, handicraft, craft printing and related trades workers<br>• Agricultural, fishery and related labourers |

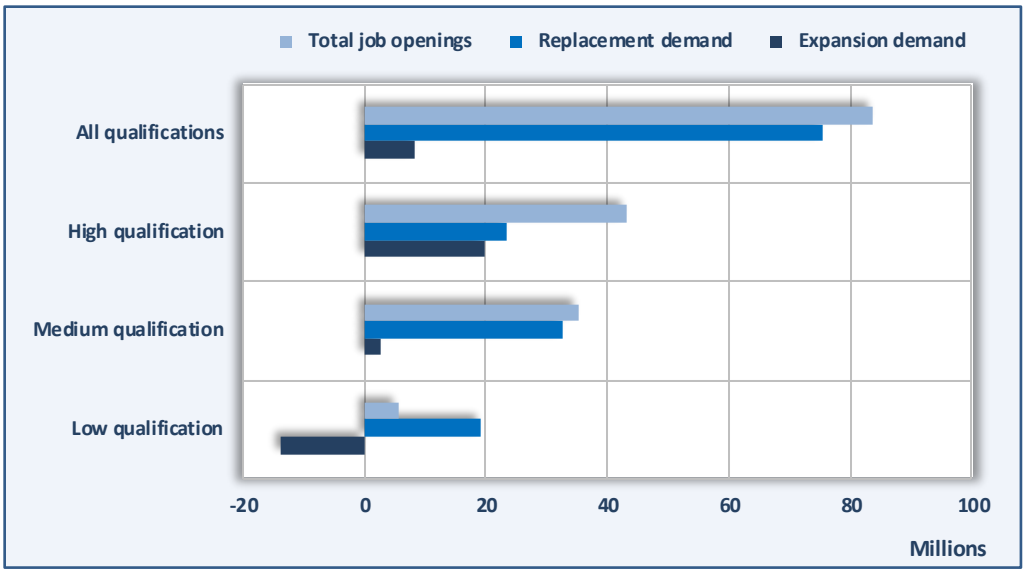
NB: Occupations are not listed in any order of priority.
*Source*: Cedefop (based on Leney and Colombo, 2012).

## 1.5. Skill demand by qualification level

Changing employment structures in sectors are combining with skill-biased technological change, suggesting that, on balance, skill demand (as measured by formal qualifications) will rise.

Figure 11 combines expansion and replacement demand by qualification level. Of the total of 75 million job opportunities projected due to replacement demand, about 23 million will be for jobs requiring high-level qualifications and 32 million for medium-level qualifications. Due to replacement needs there will be about 5.5 million new job opportunities for people with low-level or no qualifications.

Figure 11 **Total job openings by qualification, EU-27+**




*Source*: Cedefop.

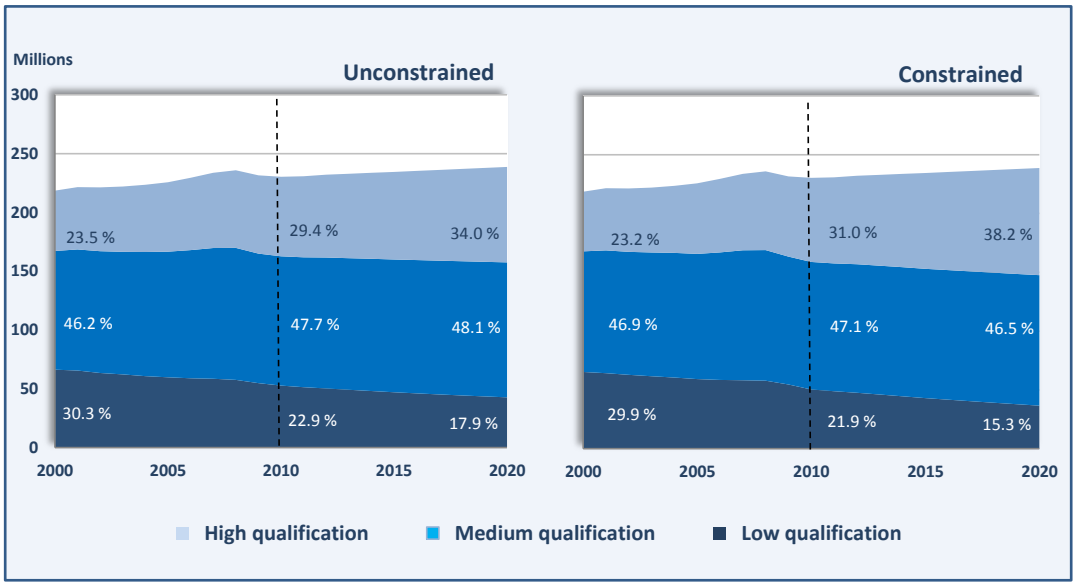
Figure 12 shows changes forecast ([14]) for unconstrained demand for formal qualifications, not affected by any likely developments in the supply. In practice, however, future employment patterns will reflect both demand and supply factors. Expected increases in numbers and proportions of the labour force holding both intermediate and higher qualifications are already in the pipeline. In general, better qualified people have more success in obtaining and retaining jobs than those less well qualified. Better qualified people may also find a job at the expense of someone less well qualified. This change in the supply pattern is reflected in the constrained demand forecast ([15]).

The upward trend is clearly visible in both forecasts. Both show increasing shares of employment for those with high-level qualifications and a fall in numbers of people with low-level or no qualifications who have a job. However, in terms of proportions and absolute numbers the two forecasts give quite different results.

([14]) The changes assume past patterns of employment shares for the three broad qualification categories (high, medium and low) in occupations and sectors will continue.

([15]) Estimates in Figure 12 (constrained) are based on allocating forecast numbers of economically active qualified people, net of those unemployed, to jobs expected to be available, taking account of historical patterns of employment share by qualification level.

Figure 12 **Employment share by qualification: unconstrained and constrained demand**




*Source*: Cedefop (IER estimates).

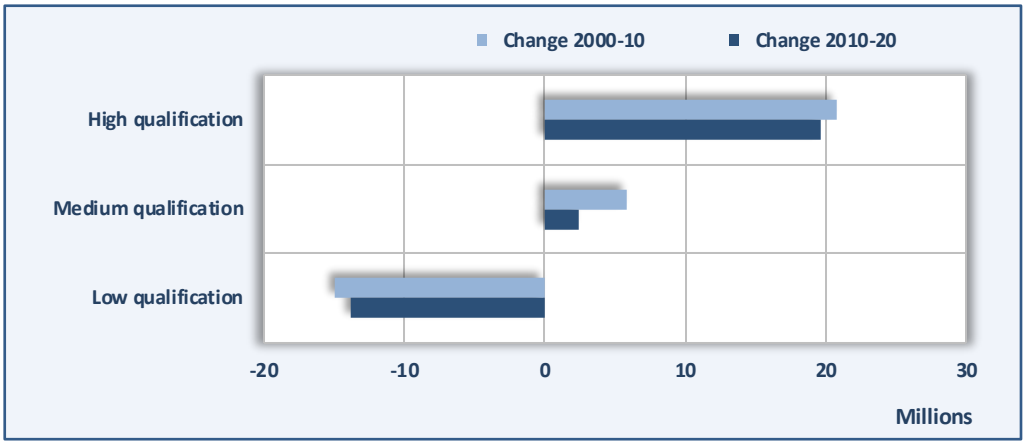
The proportion of people in employment with high-level qualifications in 2020 according to the unconstrained demand forecast is 34%. Taking account of changes caused by skill supply, the constrained demand forecast is that people with high-level qualifications in 2020 will account for 38.2% of jobs. The unconstrained demand forecast sees 17.9% of jobs occupied by people with low-level qualifications in 2020. The figure for the constrained forecast is 15.3%.

Translating these percentage changes into numbers, the unconstrained demand forecast indicates an increase in employment of 13.5 million people with high-level qualifications between 2010 and 2020. Demand for people with medium-level qualifications is expected to increase by around five million. In contrast, demand for people with low-level, or no qualifications is projected to fall by around 10 million.

However, the constrained demand forecast (Figure 13) shows an increase in demand for people with high-level qualifications in employment between 2010 and 2020 of almost 20 million, a much smaller growth for those with medium-level qualifications of about 2.5 million and a decline of almost 14 million for those with low-level or no qualifications.

The constrained demand forecast indicates strongly that the general level of qualification needed to perform jobs of all types is expected to increase up to 2020 (Figure 14). Elementary occupations and or service and sales workers, jobs that have, traditionally, not required medium- or high level-qualifications, increasingly require people who have them.

Figure 13 **Past and projected demand for qualifications, constrained, EU-27+**




*Source*: Cedefop (IER estimates).

Patterns of qualification mix, namely the shares of employment of the different qualification levels in the particular country are fairly common across all countries (Figure 14). Although to varying degrees all countries are facing the same drivers of change: demography, globalisation, international competition and cost pressures. Technological and organisational change are seeing routine tasks being substituted by technology, while demand for occupations and qualifications are also being affected by relocation and outsourcing.

There are some notable differences, depending upon the stage of economic development, and different industrial structures. For example, although Portugal will see a substantial reduction in the employment share of people with low-level qualifications, they will still account for 50% of all jobs in 2020.

Contrary to the general trend, Denmark and Norway will see an increase in the proportion of jobs filled by people with low-level qualifications, between now and 2020. In Switzerland the proportion is expected to be stable up to 2020.

In almost all countries people with medium-level qualifications will occupy most jobs. In several countries including Belgium, Bulgaria, Germany, Ireland, Greece, Italy, Lithuania, Luxembourg, Malta, Portugal and the UK, the employment share of people with medium-level qualifications is forecast to rise, generally at the expense of jobs filled by people with low-level qualifications.

In all countries, with the exceptions of Estonia and Lithuania, the employment share of people with high-level qualifications is expected to rise.

## 1.6. Conclusions

Encouragingly, despite economic setbacks and general gloom, European demand for labour is expected to increase in the years up to 2020. Europe will generate new jobs, although not as many as hoped before the 2008 financial crisis. However the real driver of job opportunities in the coming years up to 2020 is replacement demand. As the post-war baby boom generation retires there will be job openings in all sectors and for all types of occupations.

But the jobs they leave for the next generation will be different. Jobs are changing in terms of sectors, occupations and qualification levels.

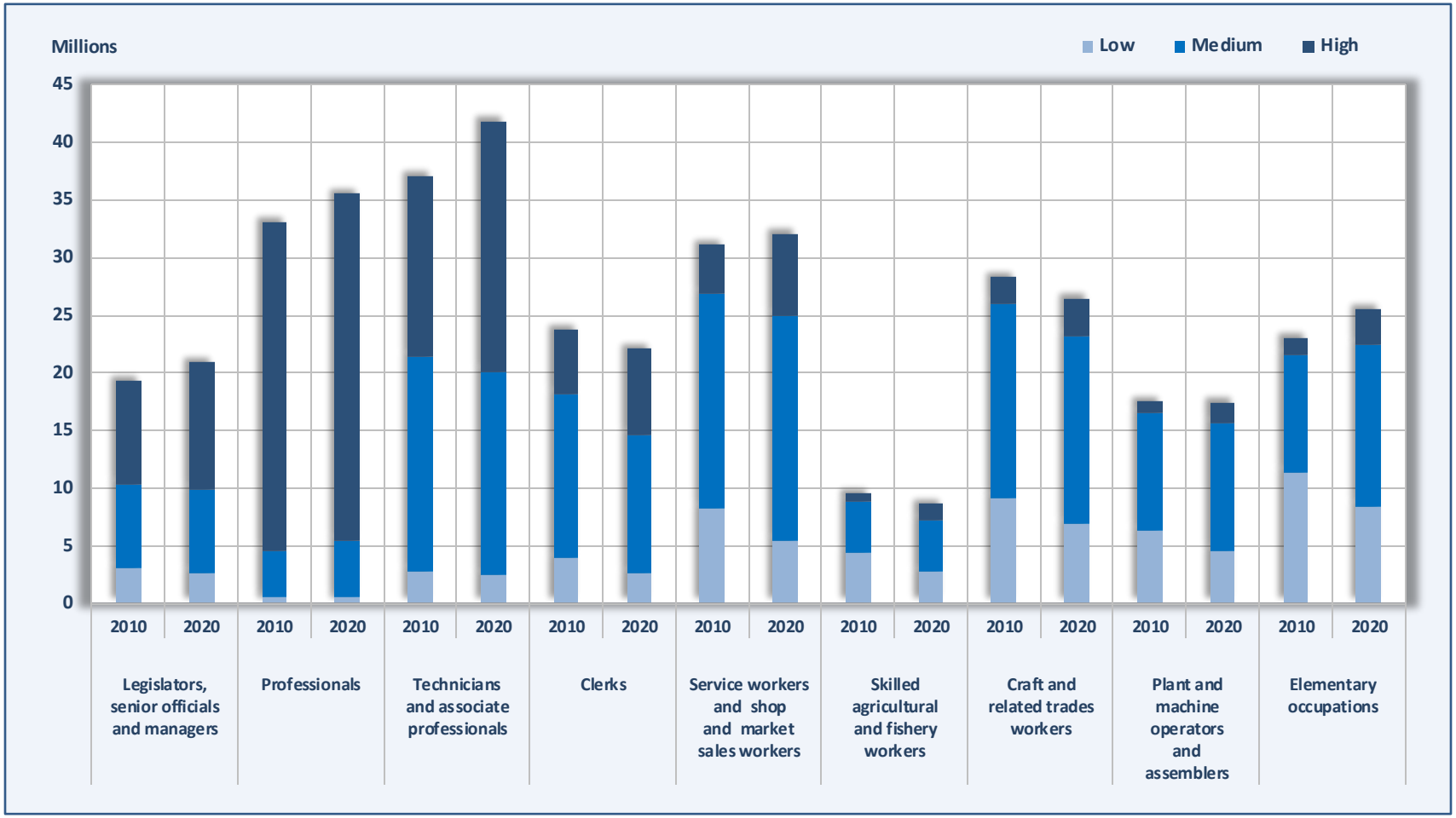
The long-term trend in the shift away from the primary and manufacturing sectors towards services, which will be the main area of job growth, will continue. Although they remain important sources of jobs, some skilled occupations requiring medium-level qualifications, are, in terms of employment share, in decline across all sectors. They include skilled agricultural and fishery workers, craft workers and clerks.

Highly-qualified technicians and associate professionals are becoming increasingly important in the modern economy. In services, polarisation between demand for high-skilled and low-skilled jobs is quite sharp. Some previously low-skill jobs now call for medium- or even high-level qualifications.

This reflects the changing nature of jobs and the different tasks that people have to do. Changes in technology have made jobs less routine lowering demand for some traditional technical, craft and clerical skills. Many jobs require a combination of transversal core competences and specialist skills. Changes in work organisation have led to more multiskilling and increased demand for personal, mathematical, scientific and analytical skills.

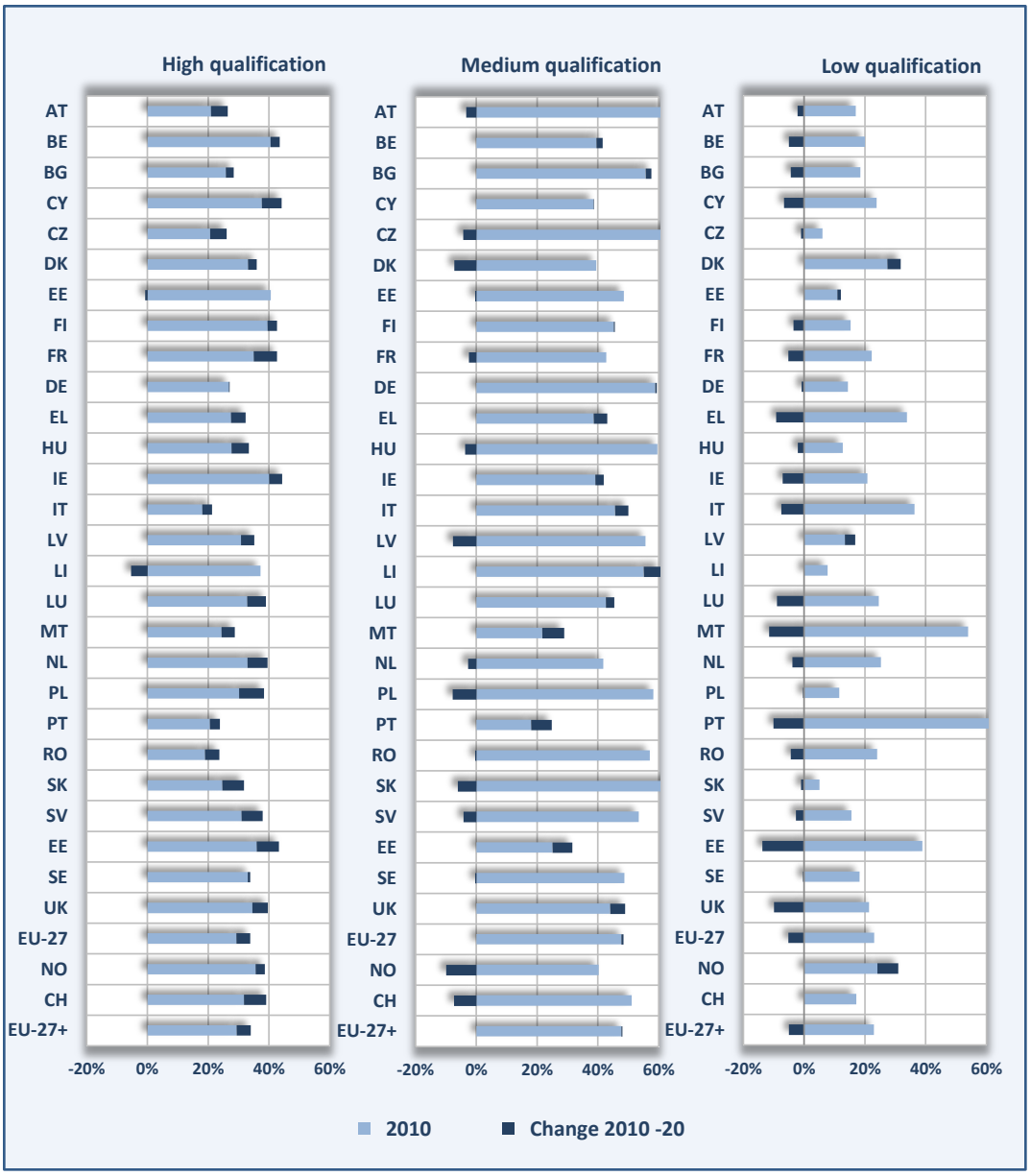
The question is can Europe's labour force keep pace with these changes?

Figure 14 **Qualification structure across occupations, EU-27+**




*Source*: Cedefop (IER estimates).

Figure 15 **Qualification mix by country**




*Source*: Cedefop.

CHAPTER 2.

# Forecast for skill supply

Trends in the population and labour force for EU-27+ are towards a more highly-qualified workforce.

By 2020, more than 80% of the total labour force ([16]) will have at least medium-level qualifications. The fastest growth will be of people acquiring high-level qualifications ([17]).

Although the total EU-27+ population aged over 15 will increase by around 12.6 million, between 2010 and 2020, the labour force (those participating in the labour market) will increase only by 5.2 million, mainly because the population is ageing. In 2020, there will be many more people over 65 compared to 2010, most of which will no longer be in the labour force. The increase in the labour force will be concentrated on those aged over 45, who will account for 42% of the labour force in 2020, compared to 39% in 2010.

Overall labour force size, or the economic activity rate, is affected by qualification levels and gender. The higher someone's qualifications, the more likely they are to participate in the labour market. Activity rates for men are higher than for women, but this may change. Increasingly more women are becoming more highly-qualified and at a faster rate than men. More women are, therefore, likely to either stay in or return to the labour market after an absence for, for example, family reasons.

This chapter outlines Cedefop's latest medium-term forecast of skill supply in EU-27+. Skill supply forecast depends on demographic developments (population size and structure by age and gender) ([18]), prospects for labour market activity rates ([19]) and patterns of acquisition of qualifications. The chapter sets out its assumptions concerning the size and structure of the population and

([16]) The labour force, or economically active population, is that part of the working age population aged over 15 which is either employed, or unemployed and actively searching for work (International Labour Organisation definition).

([17]) Cedefop forecast recognises three broad levels of qualification compatible with ISCED low = ISCED 1 and 2, medium = ISCED 3 and 4, high = ISCED 5 and 6.

([18]) Demographic projections include Eurostat assumptions about migration. See: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Population_projections.

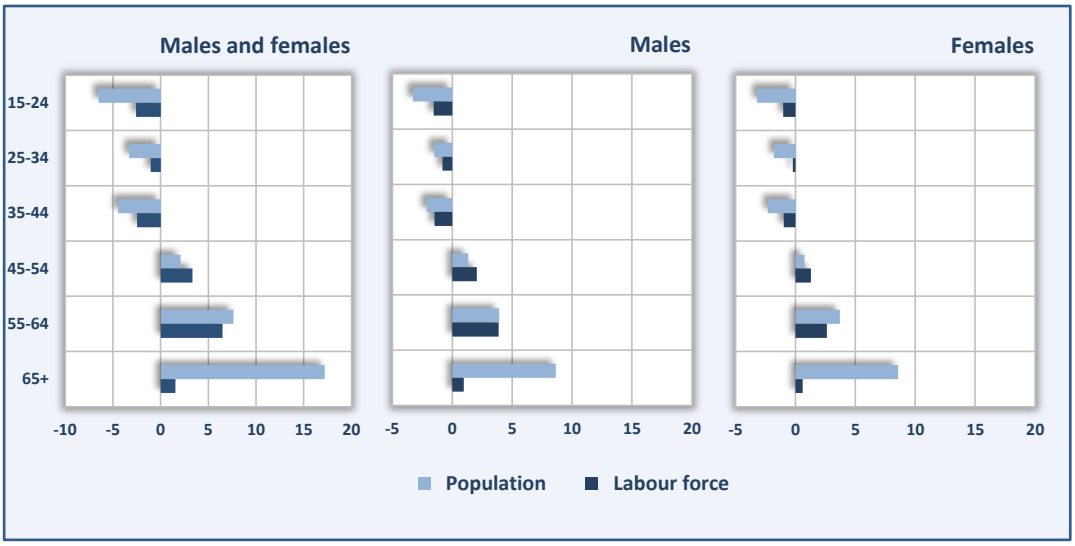
([19]) Prospects for overall labour market activity rates are based on an econometric analysis of participation decision by age and gender, using labour force survey (LFS) data for each country, and described in Pollitt and Zhao (2012).

labour force. It includes a brief discussion on the effects of migration and then analyses skill supply which is measured by numbers of people holding different levels of qualifications. Individuals are classified according to their highest qualification achieved before entering the labour market. The chapter ends with some brief conclusions.

## 2.1. Size and structure of the population and labour force

The EU-27+ population aged 15 and over is forecast to increase by 12.6 million over the period 2010-20, but the labour force will grow by only 5.2 million. Figure 16 shows how the population and labour force are ageing, with an increasing share of people aged over 45.

Figure 16 **Age structure of labour force by age and gender, change 2010-20, EU-27+**

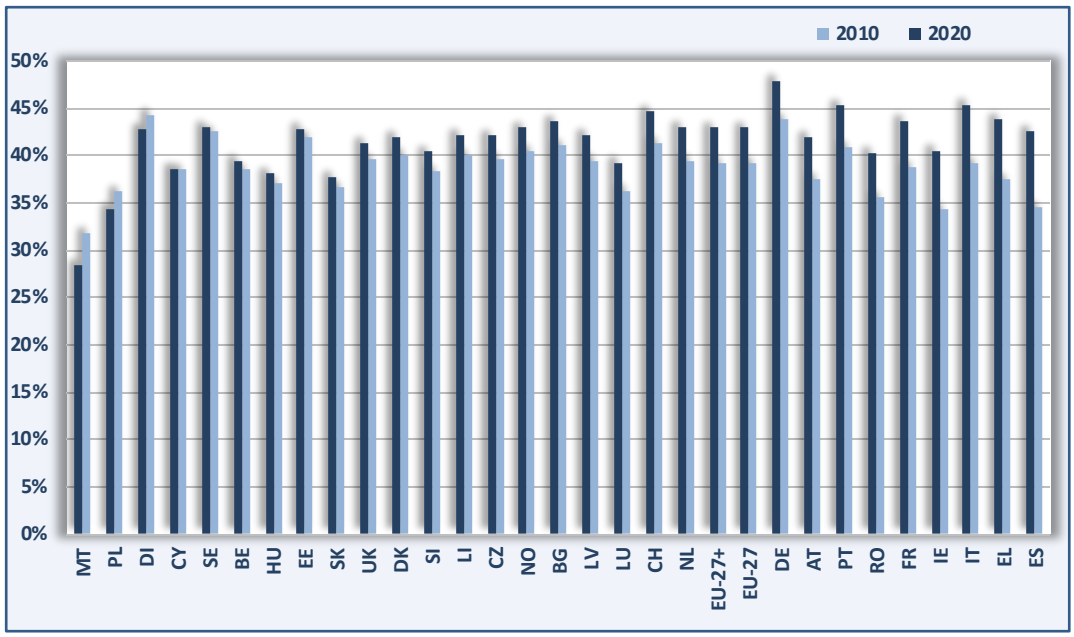



*Source*: Cedefop (IER estimates).

The share of the labour force aged over 45 differs across countries (Figure 17). In 2020, the highest shares are expected in Germany (48%), Italy (45%) and Portugal (42%). The lowest are expected to be in Malta (28%), Poland (34%) and Slovakia (38%). Between 2010 and 2020, Greece, Spain and Italy will see the fastest growth in the proportion of workers aged over 45.

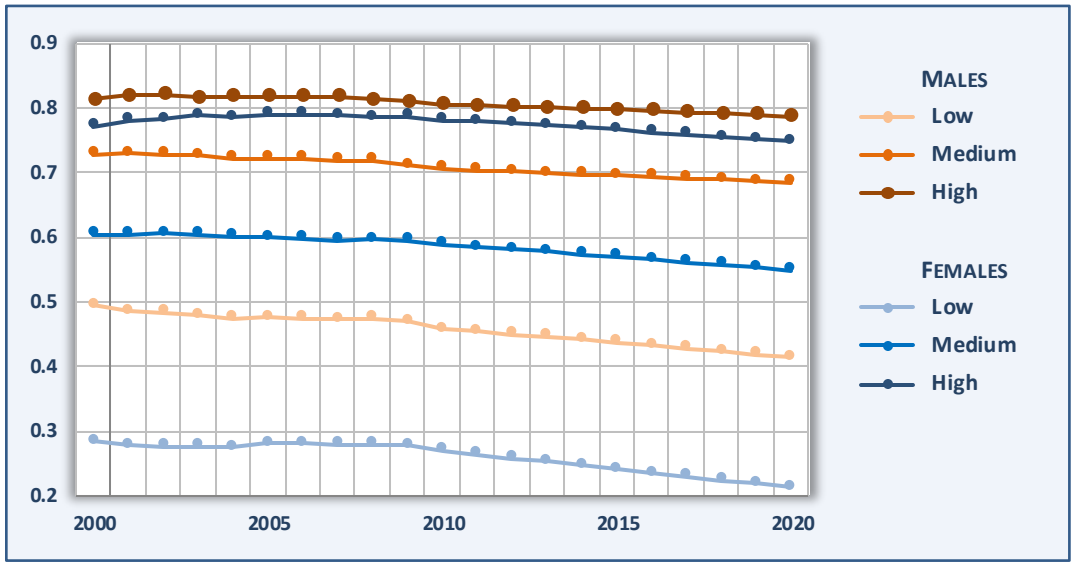
The forecast for labour market participation (or economic activity) rates, varies significantly according to qualification and gender; Figure 18). The more highly qualified someone is, the more likely they are to be economically active.

Figure 17 **Share of labour force aged over 45 by country, 2010-20**




NB: Countries are sorted by the highest differences between 2010 and 2020.
*Source*: Cedefop (IER estimates).

Figure 18 **Labour market participation (activity) rates by gender and qualification**



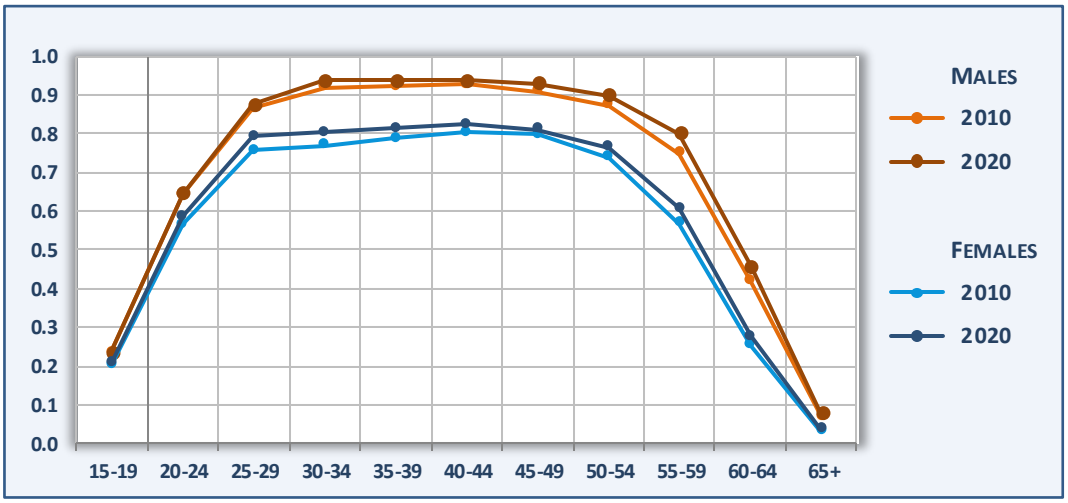

*Source*: Cedefop.

There are significant differences in activity rates by gender. Female activity rates are lower than those for males, but the difference falls the higher the qualification level. As people with high-level qualifications are more likely to be economically active and employed, this offsets negative trends for individual

qualification categories. Females with low-level qualifications are less likely to be active in the labour market compared to males with the same qualification level; the higher the qualification level, the smaller the difference between male and female labour market participation.

Participation rates disaggregated by gender and age group show some slight increases in activity rates for all age groups (Figure 19). Some older age groups and young females are expected to be more economically active. Despite of that the overall activity rate falls because of the increase in the average age and earlier retirement for many older workers. In practice, more people are taking the benefits of economic growth in leisure time rather than income, for example by retiring earlier. Government policies may raise employment and activity rates for workers between the ages of 25 and 55, but, probably, not by enough to offset this trend.

Figure 19 **Age and gender specific labour market participation rates, EU-27+**




*Source*: Cedefop (IER estimates).

## 2.2. Skill supply by qualification level

Patterns of acquisition of qualifications are based on an analysis of trends in the shares of the total population and labour force holding particular levels of qualification, broken down by country ([20]). Proportions of people in the population

([20]) StockMod logistic specification methodology, developed in (Livanos and Wilson, 2010b) was used. Alternative results were developed using pseudo cohort/stock flow model (Bosworth et al., 2012), which although conceptually superior, appeared to underestimate significantly acquisition rates of qualifications for people aged over 28.

and labour force with high- and medium-level qualifications have risen steadily in recent years in most countries. Results suggest an increase of about 20 million people in the labour force (and 29 million in the population as a whole) holding high-level qualifications in EU-27+ between 2010 and 2020 (Figure 20). This will raise the proportion of people in the labour force with high-level qualifications from 27.3% in 2010 to 37% in 2020.

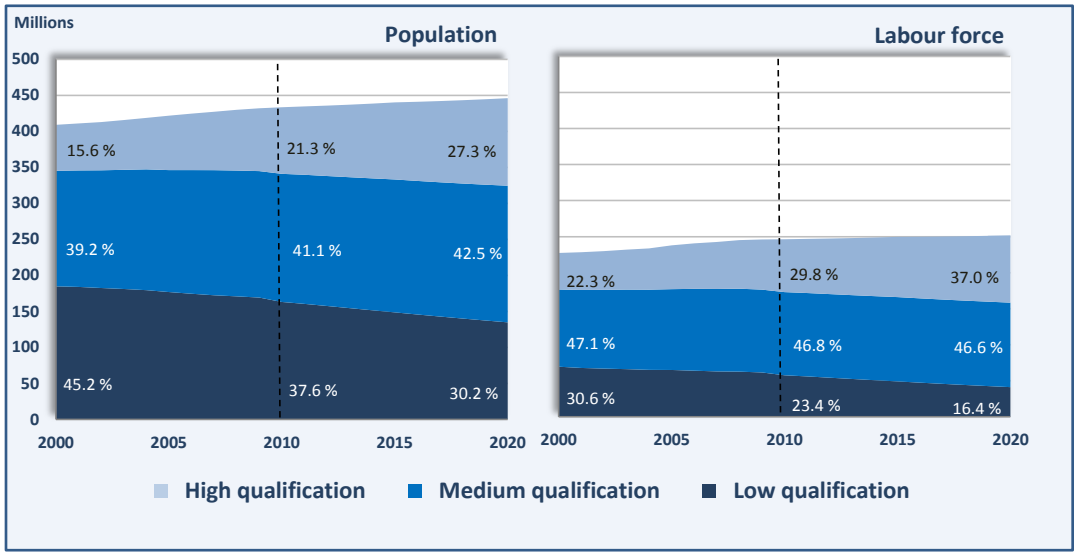
Numbers of people with medium-level qualifications are also expected to increase, but more modestly. Between 2010 and 2020, although the number of people in the total population of EU-27+ who have a medium-level qualification will rise by around 12 million, in 2020, the number in the labour force will only increase by two million. However, the proportion of people with medium-level qualifications at 46.6%, in 2020, will be higher than the 42.5% in the total population. This reflects the focus on the highest qualification held. Many people will acquire medium-level qualifications and go on to gain high-level ones.

In contrast, between 2010 and 2020 the total population in the EU-27+ with low-level or no qualifications is expected to fall by almost 30 million and the number in the labour force by around 15 million. This continues a long-term decline that has seen the proportion of people with low-level qualifications in the labour force fall from 30.6% in 2000 to a forecast 16.4% in 2020.

The lack of job opportunities due to the economic downturn has encouraged young people to stay in education and training beyond compulsory schooling. Longer-term effects may not be so positive if those better qualified young people fail to find jobs matching their expectations. In the long term strong public support of education can increase a tension in public finances due to the need to consolidate public debt. At the same time the economic slowdown can result in an increase in costs of schooling in private institutions and impose contributions to public ones which can act as a barrier to enter higher education. However, the trend of young people entering the labour market better qualified (in terms of formal education) than older people leaving, was well-established before the crisis. Consequently, we assume the crisis' impact on the increase in qualification levels will be minimal.

The level of qualification held varies significantly by age (Figure 21). For young people aged 15-24, there is likely to be only moderate increases in those with high-level qualifications as many already have them. However, numbers and the proportion of young people with medium- and low-level qualifications in the labour force are expected to fall as there will be fewer young people overall.

Figure 20 **Population and labour force by qualification, 2000-20, EU-27+**




*Source*: Cedefop (IER estimates).

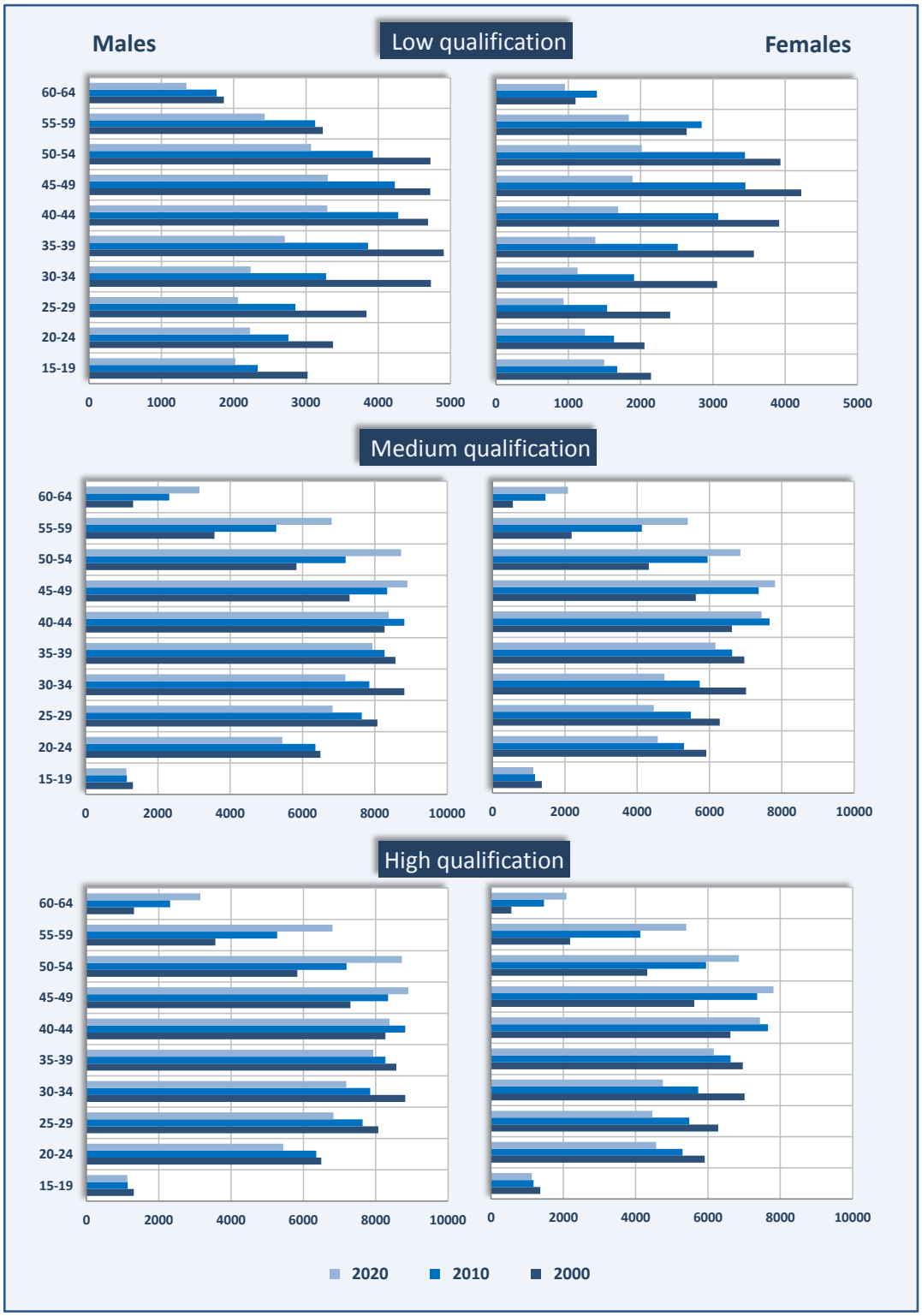
The increase in people over 25 with high-level qualifications is much greater, with the largest increase in the 30-39 age group. Figure 21 does not show progression for particular cohorts, but how qualified people are when they reach that age range.

Generally, women are gaining high-level qualifications faster than men and the proportion of women with low-level qualifications should decline more sharply (Figure 22). In connection with the evolution in participation rates (Figures 18 and 19) we can see signs that this may help improve opportunities for women, who more and more are employed in several traditionally male-dominated sectors (such as management, legislation, banking).

Increases in qualification levels are generally similar across countries, with some variations, notably for parts of central and eastern Europe (Figure 23). However, overall, convergence in qualifications and skills supply between different European countries is rather limited, reflecting differing national education and training traditions as well as different skills demands in national, sectoral and local labour markets.

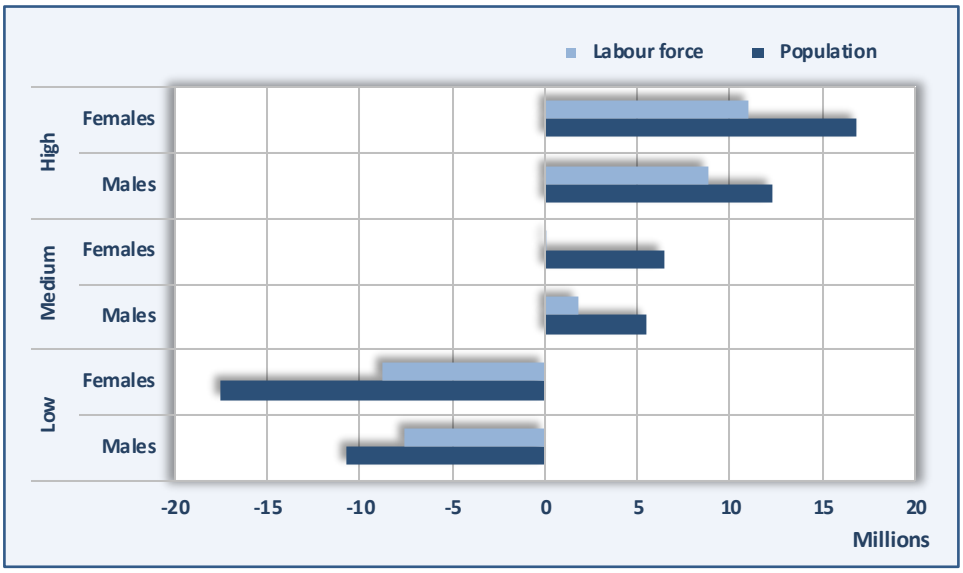
The proportion of people will low-level qualifications is forecast to fall in almost all countries between 2010 and 2020. However, the proportion of people with medium-level qualifications is set to fall in more than half of EU-27+, with the largest falls in Norway, Poland and Romania. However, this is most likely due to people going on to acquire high-level qualifications. In all countries the proportion of people with higher-level qualifications will increase in 2020 compared to 2010. The highest increases will be in Poland, Romania and Finland, while in Norway more than half of the labour force will have a high-level qualification.

Figure 21 **Labour force by gender, qualification and age group, EU-27+**




*Source*: Cedefop (IER estimates).

Figure 22 **Labour supply trends by qualification and gender, 2010-20, EU-27+**




*Source*: Cedefop.

## 2.3. Conclusions

The forecast for EU-27+ shows a significant rise in numbers of people with high-level qualifications, especially women, stabilisation in numbers of those with medium-level qualifications, and a fall in numbers with no or low-level qualifications. This has been encouraged by governments that see investment in skills as a key element in improving living standards and addressing other social and economic issues. On current trends, the EU will meet its Europe 2020 benchmark of 40% of people aged 30-34 having tertiary education ([21]).

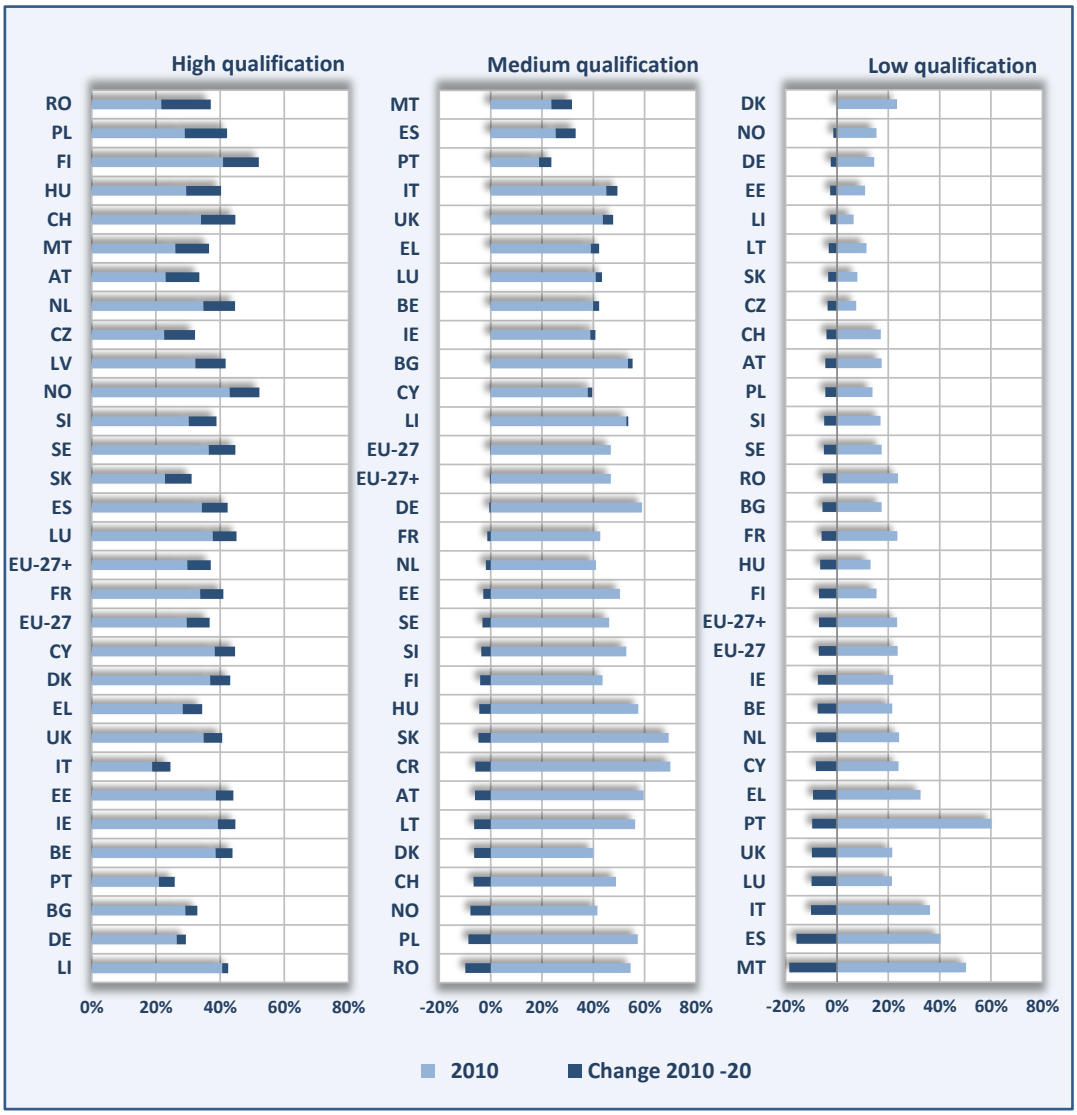
However, it cannot be assumed that the increase of the level of qualifications will simply continue. An ageing labour force has to keep up with changing skill demands and new technology. Consequently, adult workers will need opportunities not just to retrain, but also to requalify for different occupations.

Consequently, policy-makers may need to ensure that improvements in qualification levels are realised and that investment in initial education, continuing training and adult education continues.

The key issue of how, based on the forecasts, demand and supply will interact in the years up to 2020 is discussed in the next chapter.

([21]) Europe 2020 strategy http://ec.europa.eu/europe2020/index_en.htm.

Figure 23 **Shares of labour force by qualification in countries 2010-20**




NB: Countries sorted by highest increase between 2010 and 2020 for particular qualification level.
*Source*: Cedefop (IER estimates).

CHAPTER 3.

# Imbalances between skill demand and supply

Imbalances between the supply of people's skills, measured by their formal qualification level, and demand for skills, measured by the typical qualifications needed for various occupations, should not be taken at face value. They indicate the situation that will evolve if current trends in sectors, occupations and qualification levels continue rather than provide precise forecasts of shortages or surpluses.

According to Cedefop's forecasts, supply and demand are following similar trends. But those trends differ in character and the economic slowdown that has followed the financial crisis has intensified any differences.

The trends in labour demand are not as dramatic as expected immediately after the first signs of the the crisis (Cedefop, 2010). The certain risk of job polarisation is still signalled, as new job growth is concentrated in jobs requiring high-level qualifications and those which have, traditionally, required low-level ones. This trend in underpinned by technology replacing people carrying out routine tasks at all qualification levels. The scale of replacement demand, however, means that most job openings will be for jobs requiring medium-level qualifications. Importantly, almost half of the labour force will continue to be employed in jobs at this level.

The trend in supply towards a more highly-qualified workforce has been reinforced, as a lack of job opportunities has encouraged more young people to stay in education or training. On the other hand, in countries most hit by the crisis, the costs of education (as direct as opportunity costs) may now, and surely will in the long term, prohibit some young people from going into higher education.

Consequently, on the basis of Cedefop's demand and supply forecasts, it appears that, over the coming decade, there will probably be just enough people with lower- and medium-levels of qualifications to meet demand. However, supply of people with high-level qualifications seems likely to exceed demand.

This chapter discusses some implications of theses imbalances. It looks first at their possible effects on employment levels. The chapter then examines the problems of matching skill demand and supply, before concluding with a summary of the nature of the skill challenge Europe faces.

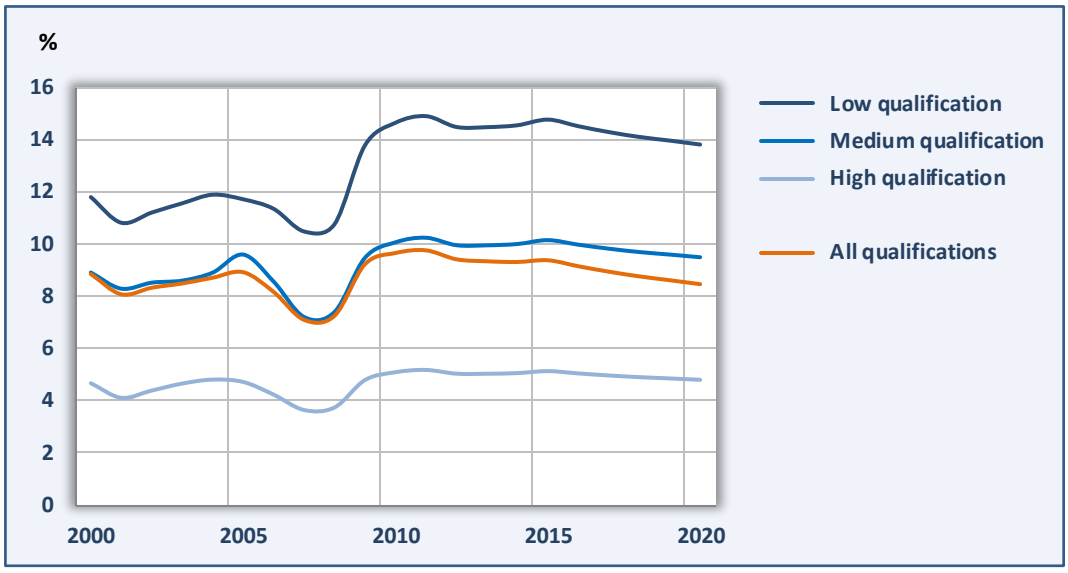
## 3.1. Implications for employment prospects

If the forecast assumptions prove correct, the EU will probably meet its target of a 75% employment rate for people aged between 20 and 64 in 2020 ([22]), as well as its benchmark of 40% of people aged 30-34 having tertiary education.

Higher qualification levels could have a positive effect on employment. The higher someone's qualification level, the more likely they are to find and keep a job. Also, the higher the qualification level the more likely it is for individuals to possess soft and other skills that can be transferred from one sector to another, which also improves job prospects.

In contrast, people, especially young people, with low-level qualifications have been hit worse by the economic downturn. They have been the first people to lose their jobs and will find it hardest to get a new one. Recent historical and forecast future paths for unemployment rates underline how job prospects are linked to the qualification level (Figure 24). In 2010, for example, those with no or low-level qualifications were almost three times as likely to be unemployed than those with high-level qualifications.

Figure 24 **Unemployment rate by qualification level, 2000-20, EU-27+**




*Source*: Cedefop (IER estimates).

To strengthen the labour force, more women and older workers need to be economically active. Despite modest job growth, it has proven difficult to keep

([22]) Europe 2020 strategy http://ec.europa.eu/europe2020/index_en.htm.

more of them in the labour market. As women become increasingly more qualified than men, more may be encouraged to stay in the labour force as they find good jobs. For older workers who have less of an incentive to acquire better qualifications at the later stages of their lives, keeping them in the labour force may be more difficult.

The share of total unemployment of people with high-level qualifications will inevitably rise as they account for an increasing proportion of the labour force. Although highly-qualified people have fared much better than those with medium- and low-level qualifications in terms of employment, they have not escaped the economic downturn unscathed.

Ironically, higher economic activity rates can actually increase the unemployment rate because of the way it is calculated ([23]). If, for example, more people decide to look for a job because they have qualifications and their prospects are better in another job, they are counted as unemployed. If they decided to stay at home and not participate in the labour market, then they would not be counted as unemployed, but economically inactive. This emphasises the importance of considering the size of the labour force as a whole as well as employment and unemployment rates, in evaluating the success of education and training policies and of taking a long- rather than short-term view. It is also important to monitor carefully movements between inactivity, training, job search and employment. If the last piece of this chain is unsuccessful people may end up unemployed again, or even leave the labour force due to frustration and demotivation.

Ultimately, employment levels result from the interaction of supply and demand. If supply does not meet demand, employers will adjust in various ways, by changing their mix of investment in capital goods, production processes, the wages they pay and the types of workers, including their qualification levels, they employ.

This implies that, depending on the overall economic situation, some people will find themselves in jobs that do not match their qualification level. In other words when job opportunities are shrinking people might be induced to accept jobs that traditionally require a lower qualification level. This is known as ‘crowding out’, where better qualified workers take jobs suitable for lesser qualified individuals.

([23]) It is important to remember that the youth unemployment rate is the number of young people who are unemployed as a proportion of those who are economically active (actually looking for a job).

## 3.2. Matching skill demand and supply

Matching skills demand and supply is more complex than simply comparing the results of the two forecasts. In fact, the trends for skill demand and supply are very similar.

For those with high-level qualifications the supply trend (measured by numbers in the labour force) has been rising more rapidly than the demand trend (measured by employment). This is forecast to continue. In contrast, for those with low-level or no qualifications demand is forecast to rise faster than supply. At medium-level, demand and supply are roughly aligned.

The implications are that there might be an increase in the number of people with high-level qualifications who are employed in jobs which has required a lower skill level in the near past. This will certainly, in the short term, cause a sharp fall in jobs for people with low-level or no qualifications. Alternatively, the greater availability of higher-educated workers in the labour force may encourage acceleration in the pace of organisational transformation towards high-performance workplaces. Empirical evidence has highlighted that firms with a greater share of overskilled/overqualified workers tend to enjoy higher productivity levels (Kampleman and Rycx, 2012). This is the outcome of positive externalities associated with a pool of higher skills, as more educated individuals can positively shape not only the nature of their own job tasks but also those of their colleagues. With proper job incentives, the greater availability of skills might also act as a spur for innovation and self-employment among young entrepreneurs.

The economic slowdown has probably exacerbated differences in skill imbalances, as proxied by the unemployment rates of people of different skill types. It is likely that for individuals with medium- and high-level qualifications the quest for suitable jobs may have become more difficult, especially in the short term. There are some indications that the positive trends in demand are less strong than before the crisis and the subsequent recession. In the short term, the recession might also create incentives for young individuals to stay on in education and training, as they face very competititive labour market conditions. However, it is not likely that this will affect long-term trends in the supply of individuals with medium- and high-level qualifications.

Knowing the nature of labour market imbalances is essential to address them appropriately. Skill shortages, for example, can hamper economic growth as firms cannot satisfy their demand for skilled labour and this will require policies to increase skill supply.

According to Cedefop's forecasts, Europe is unlikely to face difficulties in meeting the demand for higher-educated workers. However, the challenge for

Europe is to create high-skill intensity jobs that will efficiently utilise the rich set of skills possessed by the European workforce and will not allow them to become obsolete.

## 3.3. Indicators of imbalance

To examine further implications of the skill imbalances identified by the forecasts, Cedefop developed a set of indicators of imbalances (Box 1). The currently most robust of these is the indicator of future imbalances on demand (IFIOD). It looks at the likelihood of a job being filled in the future by someone with the same qualification level than required today and it describes the probability that the same qualification mix (share of high, medium and low qualified) in the occupation will remain. Based on forecasting results this share is more likely to remain stable in the higher-level occupations (such as associate professionals) than in the lower one (such as plant and machine operators) ([24]).

Box 1 **Skill imbalance indicators (overview)**

Indicator of change (IC): the change between the theoretical skill mix (the share of those with low- medium- and high-level qualifications) in the particular occupation taking into consideration historical trends and the real skill mix as affected by supply developments. For example, people with high-level qualifications taking up the posts of people with medium-level qualifications. High values of this indicator related to particular occupations imply that a significant adjustment will be needed for the occupation.

Measure of constraint (MC): this indicator calculates the adjustment of skills demand necessary from the base year to the final year of the forecast. High values of this indicator signal that a greater adjustment is needed because imbalances are high.

Indicator of future imbalances of demand (IFIOD): this indicator summarises the overall supply-demand relationship of qualification levels. The closer the indicator is to one, the lower the difficulties to recruit the appropriate skill mix.

The estimated indicators (Figure 25) imply that, in the near future, there is likely to be little difficulty in finding suitably-qualified recruits to fill jobs requiring workers with high-level qualifications. In contrast, sales, services and elementary occupations may face significant difficulties. Despite high levels of

([24]) An overview of the background theory for these indicators is the methodological annex (Annex I) and is based on the work of Humburg et al. (2012). The specialised research paper dealing with the imbalance indicators will be produced during 2013.

unemployment, there are already indications of shortages for workers to fill these jobs. Difficulties in filling vacancies for these occupations depend on several factors. These include the speed of economic recovery, the quality of working conditions (which may be poor and make these occupations unattractive) and the size of replacement demand (which is significantly high for sales, services and elementary occupations) ([25]).

National trends (Figure 26) show that the highest imbalances (measured by a weighted average of IFIOD by occupation) are in countries that already have a high share of people with high-level qualifications, such as Finland and Norway. Imbalances are also high in countries still undertaking the transition process from the primary and manufacturing sectors to services, or in countries supporting education pathways for young people to compensate for lack of job opportunities, for example Lithuania, Hungary and Romania.

Even when the general qualification level matches the job requirement, skill mismatch between demand and supply can still occur.

Some sectors or occupations are also unattractive to workers, even though the latter may have the right qualifications. For example, some sectors or jobs are unappealing because they entail 'dirty work', or offer poor career prospects.

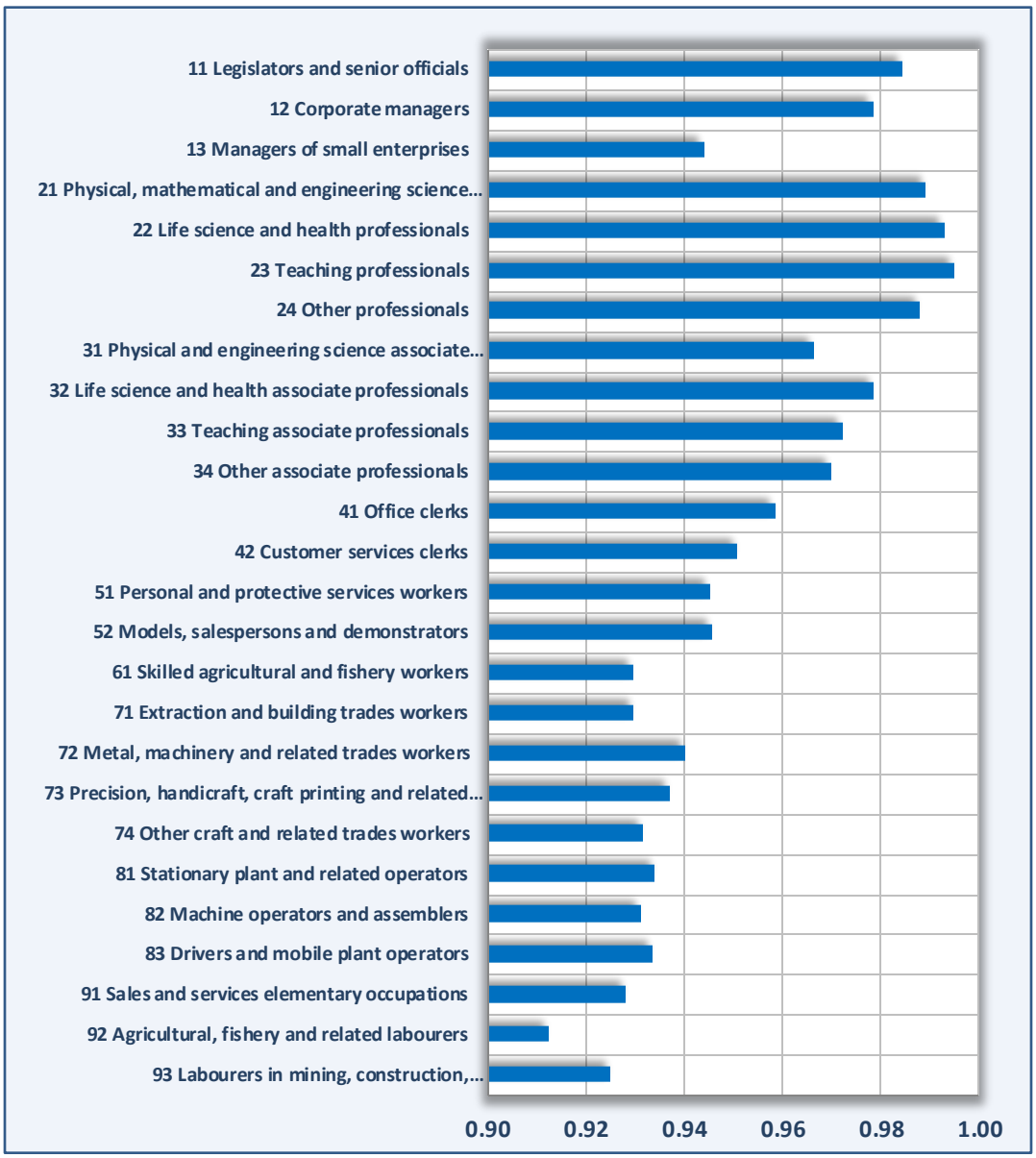
Skill mismatch can also arise when, irrespective of the level of qualifications individuals hold, subjects, or fields of study, do not match those demanded by employers ([26]). For example, employers point to shortages linked to too few young people studying science, technology, engineering or mathematics and thus report skill shortages in specific professions.

Underlining this point, the forecasts highlight that the most significant shortages are in occupations on the lower end of ISCO. Considering the results of skills demand, these are occupations where workers will need highly specific qualifications and are about to grow due to increases of non-routine tasks.

([25]) This is evident because the indicator for future difficulty on demand (IFOD) is lowest in low-skill occupations. This is confirmed by the measure of constraint (MC) which signals the largest changes in skill mixes required up to 2020.

([26]) Skill mismatch due to field of study is not currently modelled in the supply and demand forecasts due to lack of data.

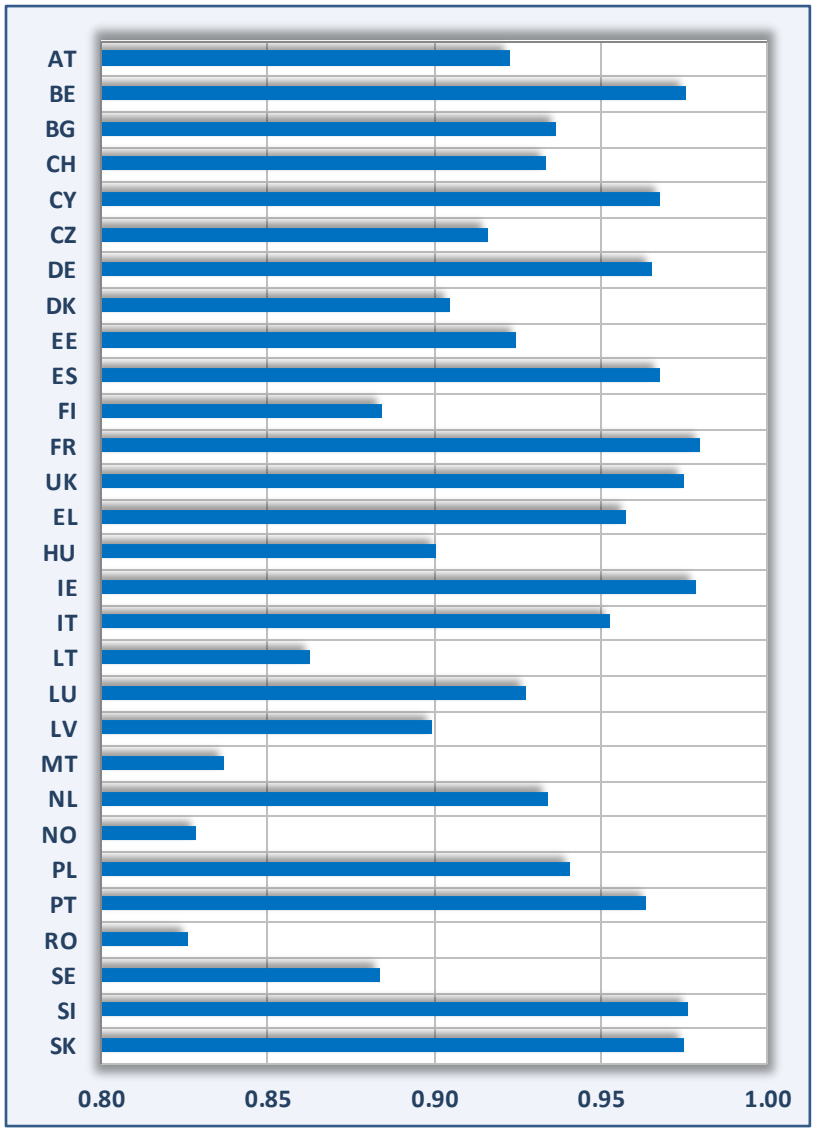
Figure 25 **Indicators of imbalances on demand by occupation, 2010-20, EU-27+**




*Source*: Cedefop.

These trends, combined with the modest economic recovery forecast and relative weak employment demand is currently increasing competition for available jobs. This makes it more difficult for some people with high- and medium-level qualifications to find the kind of jobs they would like, especially in the short term. In such circumstances, people may be more willing to accept jobs for which they are overqualified and, occasionally, part-time work or other less favourable conditions, including lower wages. Highly-qualified people then sometimes displace, or 'crowd-out' lower-skilled people from jobs.

Figure 26 **Indicators of further imbalances on demand by country, 2010-20**




*Source*: Cedefop.

Consequently, in EU-27+, although there will be variations across different countries, skill demand is expected to lag behind skill supply and may lead to skill oversupply in the short term.

## 3.4. Europe's skill challenge: getting the best out of a highly-qualified labour force

In conclusion, Cedefop's demand and supply forecasts show considerable potential for skill mismatch in Europe in 2020. With rapid technological progress

and lags in the education and training process, skill imbalances between sectors and in new or emerging occupations are likely to arise. At the same time, micro level skill mismatches are an inevitable consequence of the imperfect nature of the job search process in the labour market. This is likely to lead to a rapid increase in people with high-level qualifications employed in jobs traditionally requiring lower skill level, certainly in the short term, and a sharp fall in jobs for people with low-level or no qualifications.

Evidence on the consequences of skill oversupply is mixed. For individuals, studies indicate that people who take jobs below their qualification level often find that the state can become persistent ([27]). Their work experience does not match their qualifications, making it difficult to find another job appropriate to their qualification level. This may lower productivity as people become discouraged and frustrated in their jobs and as their skills, by being unused or undeveloped, become obsolete. At societal level, the opportunity costs of not aligning the skills of the population with the demands of the economy and society can be seen as a misallocation of resources.

However, better-qualified people have a better chance of keeping a job and, once in employment, they may be more innovative and change the nature of the job they are doing. It may be beneficial for the economy if employers can recruit better-qualified people for jobs that have not traditionally required such high skill levels. In the longer term, supply may create its own demand as availability of higher-level skills may encourage skill-biased technological change and contribute to innovation.

Further, the clear trend towards more skill-intensive jobs at all levels cannot be ignored. Routine aspects of many jobs are being increasingly processed by technology. People are now expected to deal with more non-routine tasks that require greater autonomy, planning, organisation and decision-making even at elementary level.

The extent to which expected increases in qualification levels required to carry out a certain job is due to the job itself becoming more skill-intensive, or because more better-qualified people will be available for employers to choose from, is unclear. It also depends on the strength of the economy and labour market at any given time. However, what is clear is that while skill oversupply may be for the short term, the trend of people with low-level or no qualifications finding it more and more difficult to find a job is long term.

([27]) For a discussion on skill mismatch see Cedefop (2010b) and Quintini (2011).

These trends underline the value of the EU's policy of raising the overall qualification levels of the European labour force as an investment in Europe's long-term future.

Understanding the nature of labour market and skill imbalances is essential if policy-makers, enterprises and individuals are to address them appropriately. And it is important to understand that skill mismatch is more than a discrepancy between labour market needs and particular skill levels as measured by qualifications. It is often about lack of the 'right' skills and the mismatch between what people study and the subjects that the labour market requires. Although the share of those currently leaving education and training with a university degree or equivalent is relatively higher than in the past and this number is still growing, it is difficult to plan for the specialisations and wider skills they will need. The search for the 'right' skills is, to some extent, reflected in the increasing numbers of students opting for upper-secondary, pre-tertiary and tertiary-level vocational qualifications.

But the labour market is not static and the 'right' skills change over time and in different places. Macro level skill forecasts have limits and more detailed sector, national or regional skill analyses are essential to improve the match between demand and supply. Partnerships of various stakeholders, including education and training providers, social partners and employment services are necessary to improve labour market intelligence and coordination. This can be costly, but so too is skill mismatch. Better vocational guidance and counselling services can help people make informed choices about their careers and the education and training they need. They can also help enterprises to plan and develop the skills they require.

However, the implications of the forecast's findings go beyond the need to improve forecasting techniques and obtaining a better match between skill supply and the right jobs, even though these are important.

The key policy message of the forecasts is the need to consider how to use the skill potential of the EU's labour force to the full. As qualification levels of Europe's workforce are increasing – by 2020 more than a third of the workforce will have high-level university or equivalent qualifications – the challenge is to prevent high-level skills from going to waste. Maintaining and developing them within high-skill intensity jobs is important for Europe's competitiveness.

The skill oversupply foreseen raises important policy questions about using the skill potential of the labour force. These questions concern not only how to stimulate job growth and create skill demand, but also how job design in organisations can encourage people to use the full range of their skills in any job. This is linked to the issue of how to create supportive learning cultures that

provide opportunities for employees to develop and broaden their skills to keep up with change and demand for skills such as problem-solving, information and communication, or green skills.

Last but not least, despite the clear trend towards more skill-intensive jobs, there is no guarantee that qualification levels will continue to rise. Skill supply as measured by qualifications is driven by demography and labour market trends combining with individual decisions about how much time and money (in terms of tuition fees or foregone income, or, as is increasingly the case, both) to invest in education and training. If investment in education and training does not pay off as expected – financially but also in terms of job and life satisfaction – people may become disappointed and disillusioned as their skills go to waste.

Consequently, despite skill oversupply in the short term, there is a need to maintain, or even increase investment by governments, enterprises and individuals, despite the current pressures of austerity.

It is mostly adult workers who will need to cope with changes in the future and who need to be kept in the labour force. Opportunities need to be provided to enable them to learn and qualify for different jobs at any stage of working life. If these opportunities are not forthcoming, the unqualified unemployed person of today will become the long-term unemployed person of 2020.

A highly-qualified and well-trained labour force is one of, if not the, most important factors for European competitiveness. That the EU is well on track to reach its targets to raise the qualification levels of the workforce is good news and important for economic recovery. However, there is no room for complacency. Further efforts are needed to reduce mismatch and to ensure that Europe gets the best out of the most highly-qualified and most talented workforce in its history.

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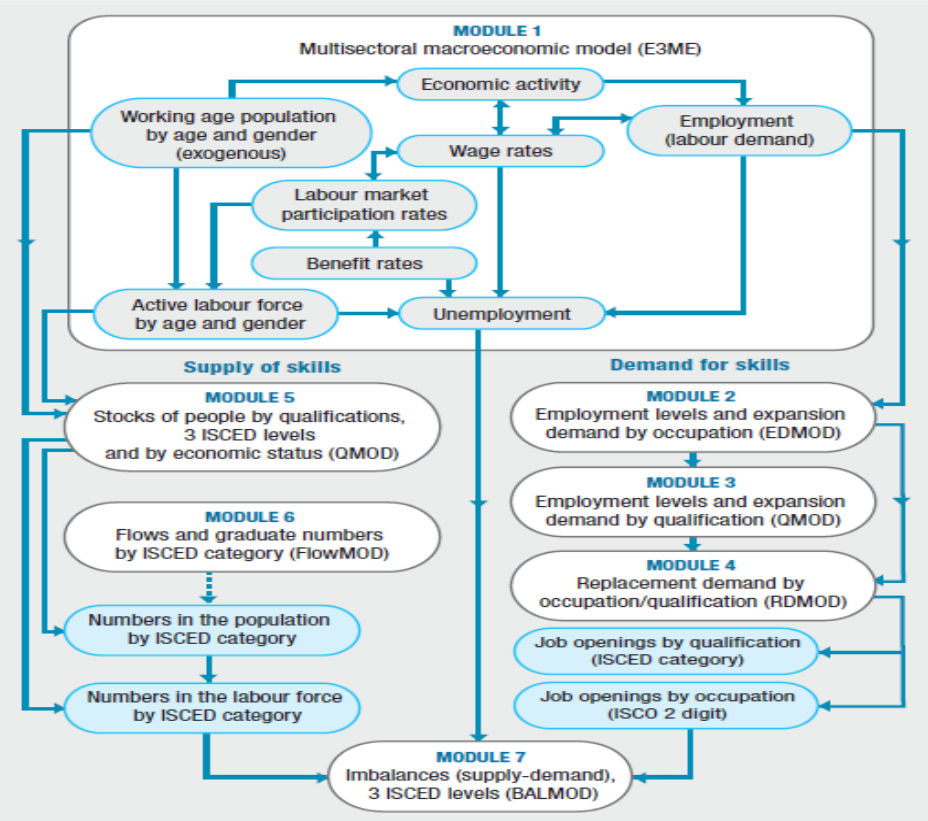
ANNEX I.
# Methodology

Cedefop's skill demand and supply forecasts are based on sound expertise and methodological tools. Understanding these tools helps to grasp better the information coming from the results. This annex presents an overview of Cedefop's approach. More detailed information on the Cedefop modelling framework is available in different Cedefop publications (Cedefop, 2010; 2012).

## General overview on modelling framework

The framework of Cedefop's methodology (Figure 27) for its skill demand and supply forecasts is modular to enable continuous improvement and development. Input data and key assumptions can be changed to develop alternative policy scenarios.

Figure 27 **Conceptual framework of modelling skill demand and supply**




Source: Cedefop (2010b).

Cedefop's forecasts do not replace national initiatives, but Cedefop's approach is unique in using harmonised data and a single methodology to provide comparable forecasts and an exclusive picture of labour market trends and skill development for the 27 EU Member States, Norway and Switzerland (EU-27+) ([28]).

Cedefop's forecasts are driven by the multisectoral, multicountry macroeconomic model ([29]), which provides consistent employment forecasts by economic sector and country. The current module combines elements of an annual econometric model and a medium-term sectoral model. Eurostat database (national accounts) and some OECD data from the STAN database are used to obtain consistent and comparable forecasts across countries. To be consistent with various EU initiatives, short-term forecasting trends were calibrated with the Directorate-General for Economic and Financial Affairs forecast ([30]).

The model produces labour market demand forecasts for 41 economic sectors/industries (compatible with ESA 95 and NACE rev 1.1), 27 occupational groups (based on ISCO 88) and three broad qualification levels (based on ISCED) ([31]).

Employment trends (expansion demand) by occupation and qualification are calculated in two different modules (EDMOD and QMOD) based on harmonised data from EU labour force survey (EU-LFS). These data enable the construction of sector/occupation or occupation/qualification matrixes. Connecting the matrixes and outputs from the multisectoral multicountry model provides results for employment by occupation and qualification. This module is based on sophisticated econometric methods which allow introducing dynamics to the different elements of the matrix (Bosworth et al., 2011; Livanos and Wilson, 2010a).

The replacement demand module calculates the need to replace those leaving the labour force. Results are crucially dependent on input data quality.

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([28]) Forecasts have been piloted for some EU candidate countries (Croatia, the Former Yugoslav Republic of Macedonia and Turkey).

([29]) More information on the underlying model is available in Pollitt et al. (2010; 2011) and Pollitt and Zhao (2012) or http://www.camecon.com/AnalysisTraining/suite_economic_models/E3ME.aspx.

([30]) For more information visit: http://ec.europa.eu/economy_finance/eu/forecasts/index_en.htm.

([31]) The forecast distinguishes three broad levels of qualifications based on ISCED: low for ISCED 1 and 2; medium for ISCED 3 and 4 and high for ISCED 5 and 6.

Current estimates are based on a cohort component method (Kriechel, 2011, 2012; Kriechel and Sauermann, 2010).

Skill supply is measured by highest formal qualification achieved by individuals. Results for population and labour force are disaggregated by five-year age groups (starting from 15-19 to 65 and more), gender and three broad qualification levels (based on ISCED). Current labour supply is a function of economic activity, real wage, unemployment rate and benefit rates. Model parameters are estimated for different countries, age groups and gender. This is important to model educational participation and attainment which are gender and age specific. This expanded model framework is then used to create a detailed set of baseline projections for labour supply (Livanos and Wilson, 2010b).

The ideal model to forecast labour supply by different qualification levels is a full stock-flow model (Bosworth and Wilson, 2011), to be able to record qualification development throughout working life, but this is difficult due to data limitations. Attempts to develop a flow model have progressed significantly, but the current approach is restricted to modelling labour force stock (Bosworth et al., 2012).

Interaction between labour demand and supply by qualification is difficult to capture. Many jobs are filled by individuals with qualifications different to those initially required. This is considered by the BalMod, which distributes disposable labour supply with certain qualifications between work places, based on assumptions of unemployment rate trends by qualification level. Final adjustments consider labour accounts to eliminate double counting (differences between the place of residence and working place), participation in further training, different definitions of unemployment and other statistical discrepancies. In line with BalMod, imbalance indicators were developed to improve interpretation of potential skill mismatch (Kriechel and Wilson, 2010; 2011).

Cedefop's results and latest methodological developments are always validated by Skillsnet experts ([32]). Skillsnet comprises wide ranging expertise including academics, labour market economists, econometricians and statisticians.

([32]) Cedefop's Skillsnet network brings together researchers and experts either in early identification of skill needs and forecasting, or the transfer of research results in this area into policy and practice. Skillsnet members contribute to various Cedefop activities related to identifying skill needs (forecasting, employer surveys, sector analysis) and have privileged access to information. For more information visit: http://www.cedefop.europa.eu/EN/about-cedefop/networks/skillsnet/skillsnet.aspx.

Forecasting is an ongoing process affected by everyday reality. Methods have to be tested for accuracy and compared with alternatives to increase the quality of results. New data are published and new policy measures affecting education and training and the labour market introduced. This highlights the need to use the most up-to-date information and a systematic approach to achieving the most reliable results.

## Imbalance indicators

Imbalance indicators (Box 2) are one of the most important recent developments in the project. The results indicate possible imbalances and can act as early warning signals for potential mismatches in occupations, overskilling or recruitment difficulties and development of such indicators is unparalleled.

The cornerstone of the imbalance indicators is the BalMod results and the concept of constrained and unconstrained skill demand. BalMod adjusts demand side estimates of qualification shares to reconcile them with available supply. From the initial, separate demand and supply forecasts, net supply (those in employment) by qualification level is calculated. To match demand and supply, a sorting model uses an iterative RAS procedure to reconcile two sets of estimates of employment. It changes the overall qualification shares from the demand for qualifications model (QMOD) to match those from the stock model of supply (StockMod), while maintaining patterns of occupational deployment and ensuring a plausible pattern of unemployment rates for different qualification levels. The RAS reconciles unconstrained employment estimates by occupation and qualification level (what employers would like to find given past trends) with projected employment supply by qualification level to produce constrained employment estimates by occupation and qualification level (how employers will use what is available, if their original, unconstrained demand for specific qualification levels cannot be met by available supply).

Box 2 **Skill imbalance indicators (detail)**

**Indicator of future imbalance of demand (IFIOD)**

IFIOD is calculated for each two digit occupation. It denotes difficulties an organisation is likely to face in hiring a worker for a specific occupation. IFIOD summarises the overall supply-demand relationship of qualification levels weighted by the likelihood that an occupation is filled by someone with that qualification level. Weighting is based on observed (base year) shares of the occupation-qualification matrix and is determined by numbers of people working with a specific background (qualification).

$$p_i = min\left(1, \frac{supply_i}{demand_i}\right)$$

$$IFIOD_j = \frac{\sum_i p_i x_{ij,t-1}}{\sum_i x_{ij,t-1}}$$

$$0 \leq IFIOD_j \leq 1$$

Where $x_{ij,t-1}$ is the total amount of people in occupation *j* with qualification type *I* in the base year (*t-1*), IFIOD gives the relative degree of expected difficulties in filling a vacancy for that occupation. Note that the share $p_i$ is the same for all occupations. It simply denotes relative supply to demand of a qualification type. The implicit assumption is that shortages in qualification types will be felt in the same way by all occupations, but weighted to the importance of the qualification type for the respective occupation. A value of 1 indicates no expected shortages. A (theoretical) 0 indicates no demand can be met. IFIOD is rank-ordered and the quintiles determine the relative level of difficulty in filling a vacancy for that occupation. A possible development could be to include fields of study to obtain more specific information (Humburg et al., 2012).

**Indicator of change (IC)**

The IC gives the percentage of change (relative to the constrained demand) that needs to be adjusted in absolute terms to reach the level of constrained demand ($D_c$) from the unconstrained demand ($D_u$). High values indicate significant adjustment is necessary. The IC is calculated for each occupation *j* across all qualification levels *i*.

$$IC_j = \frac{\sum_i |D_{c,i} - D_{u,i}|}{\sum_i D_{c,i}}$$

The IC shows the level of change needed relative to the forecast for the occupation to resolve imbalances. High values indicate high levels of constraint, and more adjustment to the current employment path.

**Measure of constraint (MC)**

MC is a similar indicator. It calculates the distance between constrained demand ($D_c$) to the base year counts ($D_1$). It gives the adjustment that is necessary from base year to the forecast.

$$MC_j = \frac{\sum_i |D_{c,i} - D_{1,i}|}{\sum_i D_{1,i}}$$

High levels indicate higher level of adjustment relative to the current (base year) of the labour market.

# Examples of detailed results for imbalance indicators

Indicators are a strong tool for cross-country comparison. This section briefly presents further possible analysis, results and interpretations of the imbalance indicators.

As an example, comparisons are made between Germany, Lithuania and EU-27. These countries make interesting comparisons. Germany is a relatively stable economy with relatively stable labour market developments and strong information flow between education and labour markets. In contrast, Lithuania's economy and labour market are relatively young having been rebuilt over the past two decades.

Simple supply to demand ratios (Table 4) show Lithuania is structurally different from Germany and the EU-27 average.

Table 4 **Supply and demand ratios by qualification level for selected countries**

*(millions)*

| | EU-27 | | | Lithuania | | | Germany | | |
|---|---|---|---|---|---|---|---|---|---|
| | LQ | MQ | HQ | LQ | MQ | HQ | LQ | MQ | HQ |
| Supply | 34.7 | 103.3 | 85.2 | 0.06 | 0.73 | 0.65 | 4.3 | 22.5 | 11.7 |
| Unconstrained demand | 39.7 | 108.0 | 75.5 | 0.11 | 0.87 | 0.46 | 5.2 | 22.9 | 10.4 |
| Ratio | 0.87 | 0.96 | 1.13 | 0.50 | 0.84 | 1.42 | 0.83 | 0.98 | 1.12 |

NB: Supply and unconstrained demand are rounded to the nearest 100.

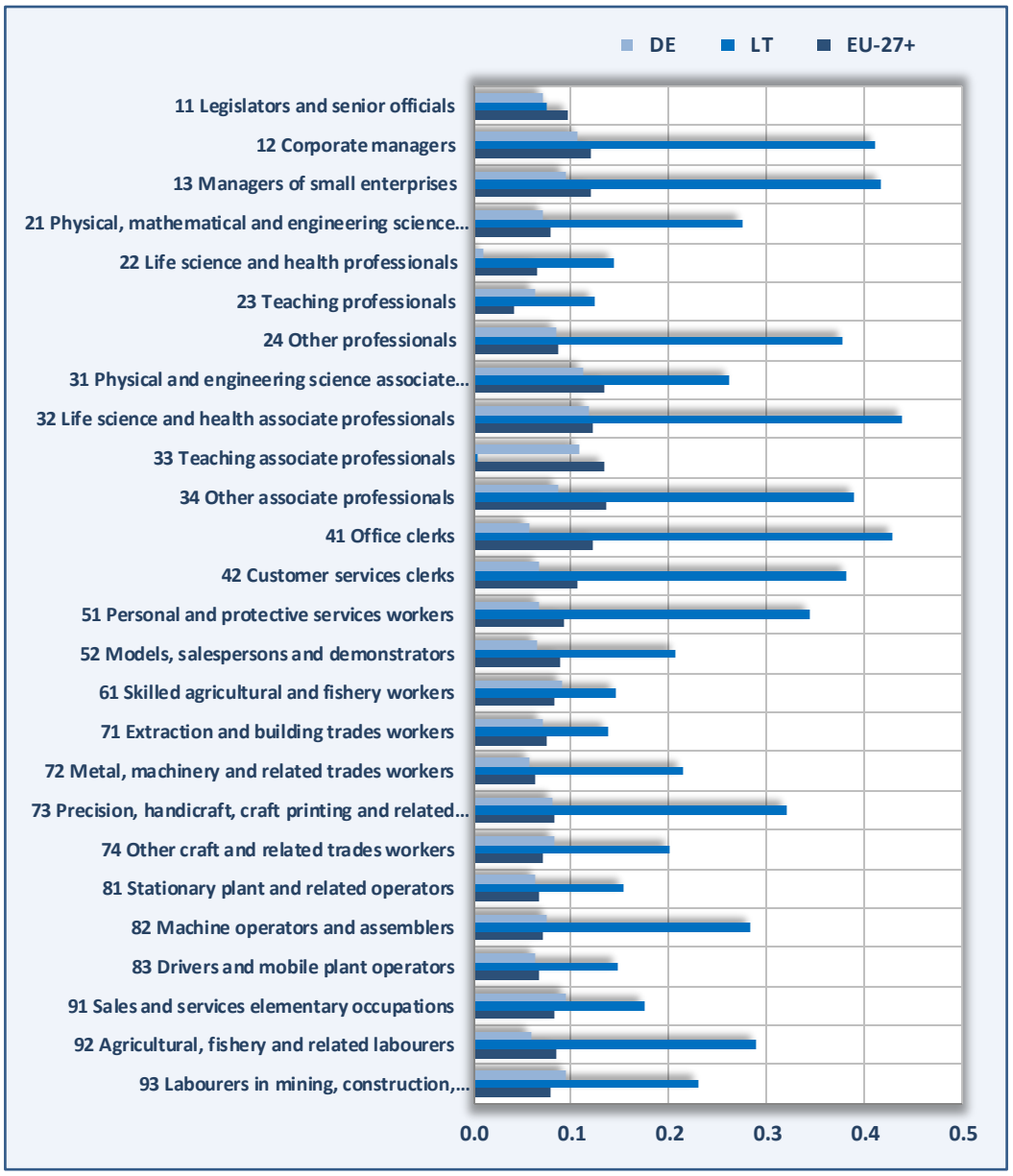
Calculations based on supply and demand estimates 2011-20. Ratios are calculated using exact estimates.

Shortages of workers with low- and medium-level qualifications are more severe in Lithuania than Germany which is closer to the EU-27 average. Excess supply of workers with high qualifications is higher in Lithuania. The numbers hint at moderate skill mismatch in Germany, but severe mismatch in Lithuania compared to EU-27.

The indicator of change (IC) gives the percentage change needed to move from unconstrained demand (Du) to constrained demand (Dc). The higher the indicator of change the more employers have to adjust their (unconstrained) demand for certain qualification levels to the available supply.

Constrained demand in Lithuania's labour market (Figure 28) is quite high, due to a severe shortage of workers with low- and medium-level qualifications. The labour market reacts by substituting some workers with low-level qualifications with others with medium-level qualifications. Substantial numbers of workers with medium-level qualifications are also substituted by workers with high-level qualifications.

Figure 28 **Indicator of change (IC) for Germany, Lithuania and EU-27+, 2011-20**



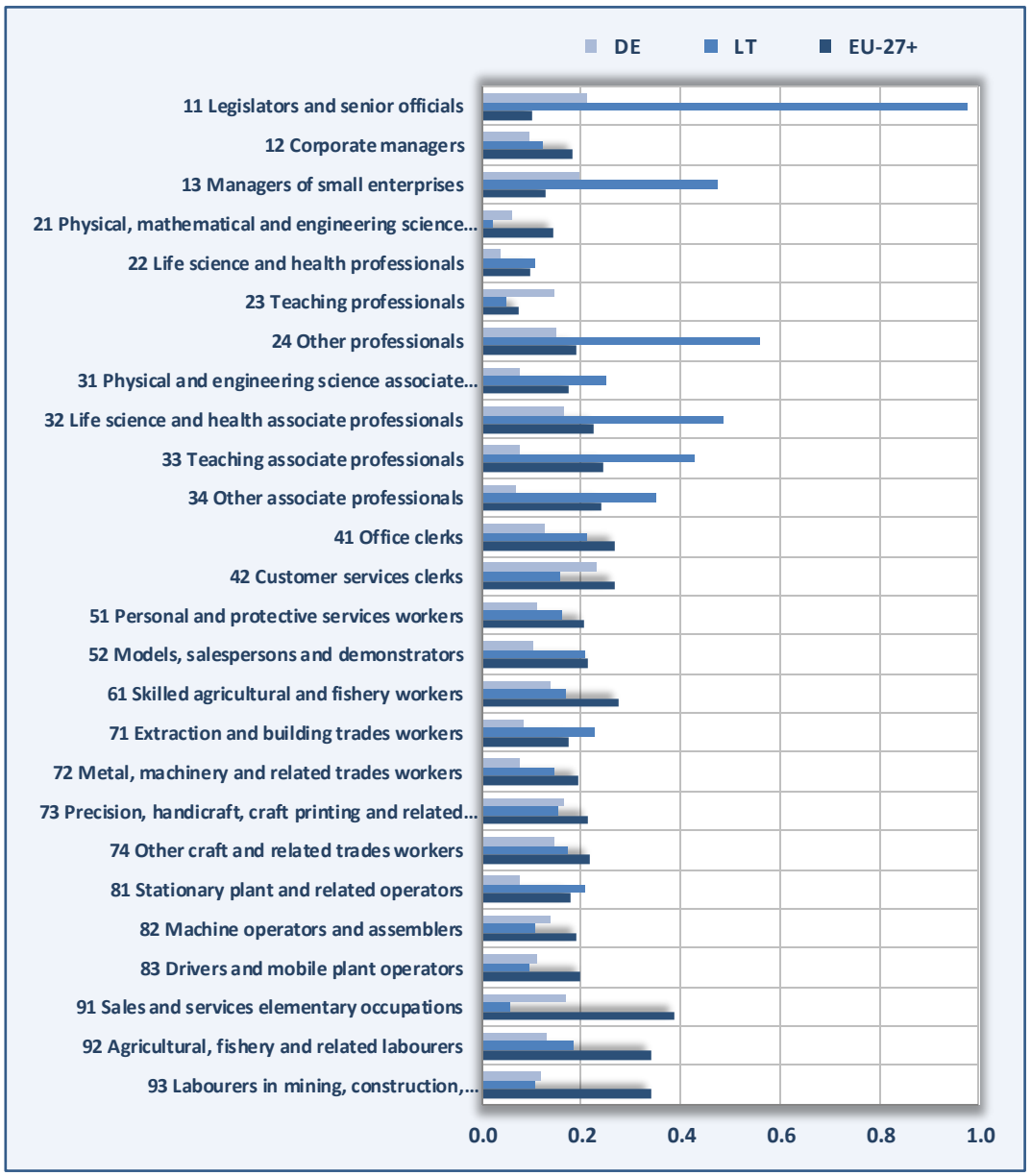

*Source*: Cedefop (calculations based on 2011 forecast, ROA).

Constrained demand in Lithuania is substantially higher than in Germany and EU-27+ across all occupations. Many occupations have discrepancies between what employers demand and what the labour force offers in terms of qualification levels. This reflects different economic situations. Lithuania is undergoing structural changes and the occupation/education mix in sectors is in flux. Germany's economy is more settled, changes are gradual. Distribution of constraint across occupations has no clear pattern. However, Germany, Lithuania

and the EU-27+ average show, constraint levels tend to be greater in jobs requiring higher- and medium-level qualifications.

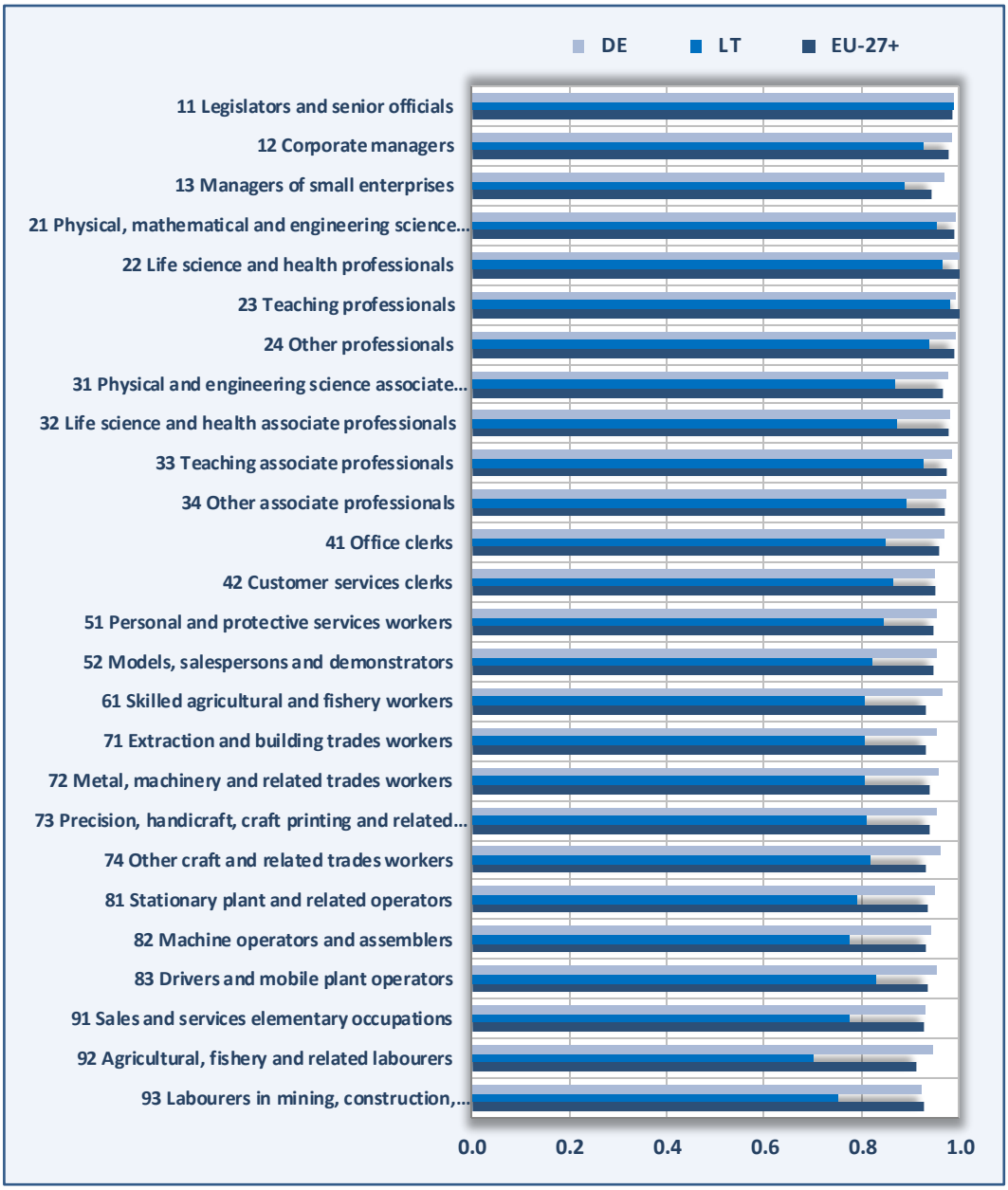
Figure 29 gives results for the measure of constraint (MC) indicator, which is the adjustment needed in qualification levels in an occupation from the base year (2010) to constrained demand at the end of the forecasting period (2020). Higher levels indicate a greater need to adjust relative to the current (base year) labour market.

Figure 29 **Measure of constraint (MC), by occupation for Germany, Lithuania and EU-27+, 2011-20**




*Source*: Cedefop (calculations based on 2011 forecast, ROA).

Figure 30 **Indicator of future imbalances of demand (IFIOD) for Germany, Lithuania and EU-27+, 2011-20**




*Source*: Cedefop (calculations based on 2011 forecast, ROA).

In contrast to the indicator of change, differences between Germany and EU-27+ are greater for the measure of constraint. For Germany, the largest adjustment to the skill mix is projected for managers of small enterprises and agricultural, fishery and related labourers. For EU-27+, the largest adjustment is projected for elementary occupations and office clerks. In Lithuania the largest

changes are expected for legislators, senior officials, teaching associate professionals and other professionals.

Figure 30 shows the indicator of future imbalances of demand (IFIOD) for Germany, Lithuania and the EU-27+.

IFIOD denotes the relative degree of difficulty an organisation is likely to face in hiring a worker for a specific occupation. A value of 1 indicates no expected shortages and a (theoretical) 0 indicates that demand cannot be met. The indicator is not strictly comparable across countries. Organisations deal with supply and demand mismatch differently according to national arrangements. The indicator's value is that it ranks within countries (on the basis of quintiles) the severity of the constraint. Supply to demand ratios above indicate that difficulties in recruiting decline the higher the level of qualification.

In Germany, the most difficulties are expected for recruiting service, shop and market sales workers, for elementary occupations and customer service clerks. Important hiring difficulties (compared to the occupations with fewest difficulties) are forecast for managers of small- and medium-size enterprises and the armed forces. The same pattern can be found in Lithuania, with relatively high levels of difficulty in recruiting for occupations requiring low- and medium-level qualifications.

ANNEX II.

# Skill demand and supply: detailed results

Table 5 **Population (15+) by age, gender and qualification, 2000-20, EU-27+**

| | All qualifications | | | | | Low qualifications | | | | | Medium qualifications | | | | | High qualifications | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Levels (000s) | | | Change 000s | | Levels (000s) | | | Change 000s | | Levels (000s) | | | Change 000s | | Levels (000s) | | | Change 000s | |
| | 2000 | 2010 | 2020 | 2000-10 | 2010-20 | 2000 | 2010 | 2020 | 2000-10 | 2010-20 | 2000 | 2010 | 2020 | 2000-10 | 2010-20 | 2000 | 2010 | 2020 | 2000-10 | 2010-20 |
| **Males and females** | | | | | | | | | | | | | | | | | | | | |
| 15+ | 409 034 | 433 398 | 446 031 | 24 365 | 12 632 | 184 781 | 163 045 | 134 731 | -21 737 | -28 313 | 160 383 | 177 913 | 189 737 | 17 529 | 11 824 | 63 869 | 92 441 | 121 562 | 28 572 | 29 121 |
| 15-19 | 31 911 | 29 617 | 27 055 | -2 295 | -2 562 | 25 436 | 23 001 | 19 921 | -2 435 | -3 080 | 6 377 | 6 278 | 6 592 | - 98 | 314 | 99 | 337 | 541 | 239 | 204 |
| 20-24 | 33 371 | 32 592 | 28 639 | - 779 | -3 953 | 7 869 | 6 500 | 4 997 | -1 369 | -1 503 | 21 392 | 20 726 | 17 416 | - 666 | -3 310 | 4 109 | 5 365 | 6 226 | 1 256 | 861 |
| 25-29 | 35 743 | 34 471 | 32 055 | -1 273 | -2 415 | 8 623 | 6 039 | 3 976 | -2 585 | -2 063 | 18 223 | 16 418 | 13 724 | -1 805 | -2 694 | 8 897 | 12 014 | 14 355 | 3 117 | 2 341 |
| 30-34 | 38 104 | 35 569 | 34 670 | -2 535 | - 898 | 10 462 | 6 958 | 4 406 | -3 504 | -2 552 | 18 567 | 16 138 | 13 862 | -2 429 | -2 276 | 9 075 | 12 473 | 16 402 | 3 398 | 3 929 |
| 35-39 | 37 788 | 37 240 | 35 689 | - 548 | -1 551 | 11 335 | 8 412 | 5 235 | -2 923 | -3 177 | 17 922 | 17 308 | 16 194 | - 614 | -1 114 | 8 531 | 11 520 | 14 260 | 2 989 | 2 740 |
| 40-44 | 36 001 | 38 942 | 36 040 | 2 941 | -2 901 | 11 583 | 9 664 | 6 349 | -1 919 | -3 314 | 16 841 | 18 711 | 17 904 | 1 870 | - 807 | 7 577 | 10 567 | 11 787 | 2 990 | 1 220 |
| 45-49 | 34 074 | 37 923 | 37 154 | 3 849 | - 769 | 12 353 | 10 230 | 6 707 | -2 123 | -3 522 | 14 931 | 18 098 | 19 239 | 3 167 | 1 141 | 6 790 | 9 595 | 11 208 | 2 805 | 1 613 |
| 50-54 | 31 605 | 35 430 | 38 283 | 3 824 | 2 854 | 13 494 | 10 589 | 7 077 | -2 905 | -3 512 | 12 484 | 16 147 | 18 996 | 3 663 | 2 848 | 5 627 | 8 693 | 12 210 | 3 066 | 3 517 |
| 55-59 | 27 167 | 32 786 | 36 656 | 5 619 | 3 870 | 12 807 | 11 230 | 7 722 | -1 577 | -3 509 | 9 910 | 14 217 | 17 819 | 4 306 | 3 602 | 4 449 | 7 339 | 11 115 | 2 890 | 3 776 |
| 60-64 | 26 196 | 29 704 | 33 455 | 3 508 | 3 750 | 14 938 | 13 279 | 9 329 | -1 659 | -3 950 | 8 099 | 11 088 | 15 425 | 2 989 | 4 338 | 3 159 | 5 337 | 8 700 | 2 178 | 3 363 |
| 65+ | 77 074 | 89 125 | 106 333 | 12 052 | 17 208 | 55 880 | 57 142 | 59 010 | 1 262 | 1 869 | 15 639 | 22 785 | 32 566 | 7 146 | 9 781 | 5 555 | 9 199 | 14 757 | 3 644 | 5 558 |
| **Males** | | | | | | | | | | | | | | | | | | | | |
| 15+ | 197 014 | 209 675 | 216 607 | 12 660 | 6 933 | 80 705 | 72 892 | 62 125 | -7 813 | -10 767 | 82 406 | 90 693 | 96 115 | 8 286 | 5 422 | 33 903 | 46 090 | 58 367 | 12 187 | 12 277 |
| 15-19 | 16 313 | 15 180 | 13 860 | -1 133 | -1 321 | 13 258 | 12 057 | 10 471 | -1 201 | -1 586 | 3 021 | 2 948 | 3 096 | - 74 | 149 | 34 | 175 | 292 | 142 | 117 |
| 20-24 | 16 948 | 16 598 | 14 620 | - 351 | -1 977 | 4 390 | 3 673 | 2 949 | - 717 | - 724 | 10 774 | 10 605 | 9 011 | - 170 | -1 593 | 1 784 | 2 320 | 2 659 | 536 | 339 |
| 25-29 | 18 067 | 17 462 | 16 355 | - 605 | -1 107 | 4 442 | 3 385 | 2 407 | -1 058 | - 977 | 9 512 | 8 888 | 7 806 | - 624 | -1 081 | 4 113 | 5 190 | 6 142 | 1 077 | 951 |
| 30-34 | 19 258 | 18 014 | 17 612 | -1 244 | - 403 | 5 244 | 3 785 | 2 552 | -1 458 | -1 234 | 9 462 | 8 512 | 7 648 | - 951 | - 863 | 4 552 | 5 717 | 7 412 | 1 165 | 1 695 |
| 35-39 | 19 011 | 18 783 | 18 046 | - 228 | - 737 | 5 475 | 4 412 | 3 057 | -1 063 | -1 355 | 9 113 | 8 914 | 8 428 | - 199 | - 486 | 4 423 | 5 457 | 6 560 | 1 034 | 1 104 |
| 40-44 | 18 014 | 19 599 | 18 191 | 1 585 | -1 408 | 5 243 | 4 937 | 3 758 | - 306 | -1 179 | 8 815 | 9 421 | 8 867 | 606 | - 554 | 3 956 | 5 241 | 5 566 | 1 285 | 325 |
| 45-49 | 16 944 | 18 934 | 18 647 | 1 990 | - 287 | 5 415 | 4 912 | 3 763 | - 502 | -1 149 | 7 880 | 9 151 | 9 556 | 1 271 | 404 | 3 649 | 4 870 | 5 328 | 1 221 | 458 |
| 50-54 | 15 655 | 17 497 | 19 110 | 1 842 | 1 613 | 5 769 | 4 752 | 3 625 | -1 017 | -1 127 | 6 686 | 8 344 | 9 844 | 1 658 | 1 500 | 3 200 | 4 401 | 5 641 | 1 202 | 1 239 |
| 55-59 | 13 289 | 15 975 | 18 048 | 2 687 | 2 072 | 5 355 | 4 763 | 3 570 | - 592 | -1 192 | 5 236 | 7 174 | 8 722 | 1 937 | 1 549 | 2 697 | 4 039 | 5 755 | 1 342 | 1 716 |
| 60-64 | 12 487 | 14 307 | 16 149 | 1 820 | 1 842 | 6 173 | 5 535 | 3 987 | - 637 | -1 548 | 4 308 | 5 711 | 7 607 | 1 403 | 1 896 | 2 007 | 3 061 | 4 554 | 1 054 | 1 493 |
| 65+ | 31 028 | 37 325 | 45 970 | 6 297 | 8 646 | 19 942 | 20 681 | 21 985 | 739 | 1 304 | 7 598 | 11 025 | 15 527 | 3 427 | 4 502 | 3 488 | 5 618 | 8 458 | 2 131 | 2 840 |

| | All qualifications | | | | | Low qualifications | | | | | Medium qualifications | | | | | High qualifications | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Levels (000s) | | | Change 000s | | Levels (000s) | | | Change 000s | | Levels (000s) | | | Change 000s | | Levels (000s) | | | Change 000s | |
| | 2000 | 2010 | 2020 | 2000-10 | 2010-20 | 2000 | 2010 | 2020 | 2000-10 | 2010-20 | 2000 | 2010 | 2020 | 2000-10 | 2010-20 | 2000 | 2010 | 2020 | 2000-10 | 2010-20 |
| **Females** | | | | | | | | | | | | | | | | | | | | |
| 15+ | 212 019 | 223 724 | 229 423 | 11 704 | 5 699 | 104 076 | 90 153 | 72 606 | -13 923 | -17 546 | 77 977 | 87 220 | 93 622 | 9 243 | 6 402 | 29 966 | 46 351 | 63 195 | 16 384 | 16 844 |
| 15-19 | 15 598 | 14 436 | 13 195 | -1 162 | -1 241 | 12 178 | 10 944 | 9 450 | -1 234 | -1 493 | 3 355 | 3 331 | 3 496 | - 25 | 165 | 65 | 162 | 249 | 97 | 87 |
| 20-24 | 16 423 | 15 994 | 14 019 | - 428 | -1 976 | 3 480 | 2 827 | 2 047 | - 652 | - 780 | 10 618 | 10 122 | 8 404 | - 496 | -1 717 | 2 325 | 3 045 | 3 567 | 720 | 521 |
| 25-29 | 17 676 | 17 008 | 15 700 | - 668 | -1 308 | 4 181 | 2 654 | 1 569 | -1 527 | -1 085 | 8 711 | 7 530 | 5 918 | -1 181 | -1 612 | 4 784 | 6 824 | 8 214 | 2 040 | 1 390 |
| 30-34 | 18 845 | 17 554 | 17 059 | -1 291 | - 496 | 5 218 | 3 173 | 1 855 | -2 045 | -1 318 | 9 104 | 7 626 | 6 214 | -1 479 | -1 412 | 4 523 | 6 756 | 8 990 | 2 233 | 2 234 |
| 35-39 | 18 777 | 18 458 | 17 643 | - 319 | - 814 | 5 860 | 4 000 | 2 178 | -1 860 | -1 822 | 8 809 | 8 394 | 7 766 | - 415 | - 628 | 4 108 | 6 064 | 7 700 | 1 956 | 1 636 |
| 40-44 | 17 987 | 19 343 | 17 850 | 1 356 | -1 493 | 6 340 | 4 727 | 2 592 | -1 613 | -2 136 | 8 025 | 9 290 | 9 037 | 1 264 | - 252 | 3 621 | 5 326 | 6 221 | 1 705 | 895 |
| 45-49 | 17 130 | 18 989 | 18 508 | 1 859 | - 482 | 6 939 | 5 318 | 2 945 | -1 621 | -2 373 | 7 050 | 8 947 | 9 683 | 1 896 | 737 | 3 141 | 4 725 | 5 880 | 1 584 | 1 154 |
| 50-54 | 15 950 | 17 933 | 19 173 | 1 982 | 1 241 | 7 725 | 5 838 | 3 452 | -1 888 | -2 385 | 5 798 | 7 803 | 9 152 | 2 005 | 1 348 | 2 427 | 4 292 | 6 570 | 1 865 | 2 278 |
| 55-59 | 13 878 | 16 810 | 18 608 | 2 932 | 1 798 | 7 452 | 6 467 | 4 151 | - 985 | -2 316 | 4 674 | 7 043 | 9 096 | 2 369 | 2 053 | 1 752 | 3 300 | 5 360 | 1 548 | 2 060 |
| 60-64 | 13 709 | 15 397 | 17 305 | 1 688 | 1 909 | 8 766 | 7 744 | 5 342 | -1 021 | -2 402 | 3 791 | 5 376 | 7 818 | 1 586 | 2 442 | 1 152 | 2 276 | 4 145 | 1 124 | 1 869 |
| 65+ | 46 046 | 51 801 | 60 363 | 5 755 | 8 562 | 35 938 | 36 461 | 37 025 | 523 | 565 | 8 041 | 11 759 | 17 039 | 3 718 | 5 279 | 2 067 | 3 581 | 6 299 | 1 513 | 2 718 |

NB: Visit http://www.cedefop.europa.eu/EN/about-cedefop/projects/forecasting-skill-demand-and-supply/skills-forecasts.aspx for possible updates of this table.
*Source*: Cedefop (IER estimates).

Table 6 **Labour force (15+) by age, gender and qualification, 2000-20, EU-27+**

| | All qualifications | | | | | Low qualifications | | | | | Medium qualifications | | | | | High qualifications | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Levels (000s) | | | Change 000s | | Levels (000s) | | | Change 000s | | Levels (000s) | | | Change 000s | | Levels (000s) | | | Change 000s | |
| | 2000 | 2010 | 2020 | 2000-10 | 2010-20 | 2000 | 2010 | 2020 | 2000-10 | 2010-20 | 2000 | 2010 | 2020 | 2000-10 | 2010-20 | 2000 | 2010 | 2020 | 2000-10 | 2010-20 |
| **Males and females** | | | | | | | | | | | | | | | | | | | | |
| 15+ | 227 383 | 246 371 | 251 626 | 18 989 | 5 254 | 69 560 | 57 654 | 41 210 | -11 906 | -16 444 | 107 132 | 115 374 | 117 227 | 8 242 | 1 853 | 50 691 | 73 344 | 93 189 | 22 653 | 19 845 |
| 15-19 | 7 882 | 6 474 | 5 970 | -1 409 | - 504 | 5 167 | 4 008 | 3 522 | -1 159 | - 486 | 2 674 | 2 317 | 2 257 | - 357 | - 59 | 41 | 149 | 190 | 108 | 41 |
| 20-24 | 20 652 | 19 729 | 17 660 | - 924 | -2 069 | 5 428 | 4 390 | 3 456 | -1 038 | - 934 | 12 411 | 11 653 | 10 013 | - 758 | -1 640 | 2 814 | 3 686 | 4 191 | 872 | 505 |
| 25-29 | 28 395 | 27 968 | 26 778 | - 427 | -1 191 | 6 245 | 4 391 | 2 993 | -1 854 | -1 398 | 14 360 | 13 122 | 11 292 | -1 238 | -1 830 | 7 790 | 10 455 | 12 492 | 2 665 | 2 037 |
| 30-34 | 31 858 | 30 087 | 30 223 | -1 771 | 136 | 7 786 | 5 186 | 3 361 | -2 600 | -1 824 | 15 831 | 13 582 | 11 945 | -2 249 | -1 637 | 8 241 | 11 320 | 14 917 | 3 078 | 3 597 |
| 35-39 | 31 821 | 31 849 | 31 294 | 29 | - 555 | 8 474 | 6 373 | 4 082 | -2 102 | -2 291 | 15 534 | 14 901 | 14 098 | - 632 | - 804 | 7 813 | 10 575 | 13 114 | 2 762 | 2 539 |
| 40-44 | 30 578 | 33 708 | 31 784 | 3 130 | -1 924 | 8 604 | 7 352 | 4 986 | -1 252 | -2 366 | 14 891 | 16 482 | 15 824 | 1 592 | - 658 | 7 083 | 9 874 | 10 974 | 2 791 | 1 101 |
| 45-49 | 28 201 | 32 374 | 32 371 | 4 173 | - 3 | 8 939 | 7 678 | 5 190 | -1 261 | -2 488 | 12 926 | 15 705 | 16 715 | 2 779 | 1 010 | 6 336 | 8 991 | 10 466 | 2 655 | 1 475 |
| 50-54 | 23 977 | 28 508 | 31 833 | 4 531 | 3 325 | 8 654 | 7 369 | 5 088 | -1 285 | -2 281 | 10 162 | 13 144 | 15 586 | 2 982 | 2 442 | 5 160 | 7 995 | 11 159 | 2 835 | 3 164 |
| 55-59 | 15 017 | 21 513 | 25 741 | 6 496 | 4 228 | 5 870 | 5 973 | 4 266 | 103 | -1 707 | 5 750 | 9 408 | 12 208 | 3 658 | 2 800 | 3 398 | 6 133 | 9 268 | 2 735 | 3 135 |
| 60-64 | 6 240 | 9 896 | 12 160 | 3 657 | 2 264 | 2 963 | 3 159 | 2 299 | 195 | - 859 | 1 875 | 3 777 | 5 240 | 1 902 | 1 463 | 1 402 | 2 961 | 4 621 | 1 559 | 1 660 |
| 65+ | 2 761 | 4 264 | 5 812 | 1 503 | 1 548 | 1 430 | 1 776 | 1 967 | 346 | 191 | 718 | 1 283 | 2 048 | 565 | 765 | 613 | 1 205 | 1 797 | 592 | 592 |
| **Males** | | | | | | | | | | | | | | | | | | | | |
| 15+ | 127 531 | 134 487 | 137 473 | 6 955 | 2 987 | 39 912 | 33 329 | 25 715 | -6 582 | -7 615 | 60 052 | 64 029 | 65 810 | 3 977 | 1 781 | 27 568 | 37 128 | 45 948 | 9 560 | 8 820 |
| 15-19 | 4 346 | 3 553 | 3 256 | - 793 | - 296 | 3 022 | 2 332 | 2 024 | - 690 | - 308 | 1 310 | 1 143 | 1 128 | - 167 | - 14 | 14 | 78 | 104 | 64 | 26 |
| 20-24 | 11 051 | 10 698 | 9 443 | - 353 | -1 255 | 3 375 | 2 757 | 2 228 | - 618 | - 530 | 6 497 | 6 358 | 5 444 | - 139 | - 914 | 1 179 | 1 582 | 1 771 | 403 | 189 |
| 25-29 | 15 586 | 15 102 | 14 315 | - 484 | - 787 | 3 837 | 2 855 | 2 058 | - 982 | - 796 | 8 074 | 7 636 | 6 829 | - 438 | - 806 | 3 675 | 4 611 | 5 427 | 937 | 816 |
| 30-34 | 17 832 | 16 557 | 16 525 | -1 275 | - 32 | 4 727 | 3 278 | 2 234 | -1 449 | -1 044 | 8 816 | 7 848 | 7 190 | - 968 | - 658 | 4 289 | 5 431 | 7 101 | 1 142 | 1 670 |
| 35-39 | 17 736 | 17 328 | 16 943 | - 408 | - 385 | 4 907 | 3 858 | 2 707 | -1 049 | -1 151 | 8 571 | 8 272 | 7 934 | - 300 | - 337 | 4 258 | 5 198 | 6 301 | 940 | 1 103 |
| 40-44 | 16 804 | 18 178 | 17 075 | 1 375 | -1 104 | 4 688 | 4 278 | 3 295 | - 410 | - 983 | 8 271 | 8 821 | 8 384 | 549 | - 437 | 3 844 | 5 080 | 5 395 | 1 236 | 316 |
| 45-49 | 15 539 | 17 235 | 17 357 | 1 697 | 122 | 4 718 | 4 228 | 3 301 | - 489 | - 927 | 7 301 | 8 343 | 8 901 | 1 042 | 558 | 3 520 | 4 664 | 5 155 | 1 144 | 491 |
| 50-54 | 13 604 | 15 261 | 17 172 | 1 658 | 1 910 | 4 721 | 3 925 | 3 069 | - 796 | - 856 | 5 836 | 7 194 | 8 727 | 1 358 | 1 533 | 3 046 | 4 142 | 5 375 | 1 096 | 1 233 |
| 55-59 | 9 050 | 11 972 | 14 460 | 2 922 | 2 488 | 3 233 | 3 128 | 2 429 | - 105 | - 699 | 3 564 | 5 276 | 6 810 | 1 712 | 1 534 | 2 253 | 3 568 | 5 221 | 1 315 | 1 653 |
| 60-64 | 4 210 | 5 988 | 7 367 | 1 778 | 1 379 | 1 864 | 1 764 | 1 348 | - 100 | - 416 | 1 314 | 2 312 | 3 153 | 998 | 841 | 1 032 | 1 913 | 2 867 | 880 | 954 |
| 65+ | 1 774 | 2 614 | 3 559 | 840 | 946 | 820 | 927 | 1 021 | 106 | 94 | 497 | 826 | 1 309 | 330 | 482 | 457 | 860 | 1 230 | 404 | 370 |
| **Females** | | | | | | | | | | | | | | | | | | | | |
| 15+ | 99 851 | 111 885 | 114 152 | 12 033 | 2 268 | 29 648 | 24 324 | 15 495 | -5 324 | -8 829 | 47 080 | 51 345 | 51 417 | 4 265 | 72 | 23 123 | 36 216 | 47 240 | 13 092 | 11 025 |
| 15-19 | 3 536 | 2 921 | 2 714 | - 616 | - 207 | 2 145 | 1 676 | 1 498 | - 469 | - 178 | 1 364 | 1 174 | 1 129 | - 190 | - 45 | 27 | 71 | 86 | 44 | 15 |
| 20-24 | 9 601 | 9 031 | 8 217 | - 570 | - 814 | 2 053 | 1 633 | 1 228 | - 420 | - 405 | 5 914 | 5 295 | 4 569 | - 619 | - 726 | 1 634 | 2 103 | 2 420 | 469 | 316 |
| 25-29 | 12 809 | 12 866 | 12 463 | 57 | - 404 | 2 408 | 1 536 | 935 | - 871 | - 602 | 6 286 | 5 486 | 4 463 | - 800 | -1 023 | 4 115 | 5 844 | 7 065 | 1 728 | 1 221 |
| 30-34 | 14 026 | 13 530 | 13 698 | - 495 | 167 | 3 059 | 1 908 | 1 127 | -1 151 | - 781 | 7 015 | 5 734 | 4 755 | -1 281 | - 979 | 3 952 | 5 889 | 7 816 | 1 936 | 1 927 |
| 35-39 | 14 084 | 14 521 | 14 351 | 437 | - 170 | 3 568 | 2 515 | 1 375 | -1 053 | -1 140 | 6 962 | 6 630 | 6 163 | - 333 | - 466 | 3 554 | 5 377 | 6 813 | 1 822 | 1 436 |
| 40-44 | 13 774 | 15 530 | 14 710 | 1 756 | - 820 | 3 916 | 3 074 | 1 690 | - 842 | -1 384 | 6 619 | 7 662 | 7 440 | 1 043 | - 222 | 3 239 | 4 794 | 5 579 | 1 555 | 785 |
| 45-49 | 12 662 | 15 139 | 15 013 | 2 477 | - 125 | 4 221 | 3 450 | 1 888 | - 771 | -1 561 | 5 625 | 7 362 | 7 814 | 1 737 | 452 | 2 816 | 4 327 | 5 311 | 1 511 | 984 |
| 50-54 | 10 373 | 13 247 | 14 661 | 2 874 | 1 415 | 3 933 | 3 444 | 2 019 | - 489 | -1 425 | 4 326 | 5 950 | 6 859 | 1 624 | 909 | 2 114 | 3 853 | 5 784 | 1 739 | 1 931 |
| 55-59 | 5 967 | 9 541 | 11 281 | 3 574 | 1 740 | 2 637 | 2 845 | 1 836 | 208 | -1 008 | 2 186 | 4 131 | 5 398 | 1 945 | 1 266 | 1 145 | 2 565 | 4 047 | 1 420 | 1 482 |
| 60-64 | 2 030 | 3 908 | 4 793 | 1 878 | 885 | 1 099 | 1 395 | 952 | 295 | - 443 | 561 | 1 465 | 2 087 | 904 | 623 | 370 | 1 048 | 1 754 | 679 | 705 |
| 65+ | 987 | 1 650 | 2 253 | 663 | 602 | 609 | 849 | 947 | 240 | 97 | 221 | 456 | 739 | 235 | 283 | 157 | 345 | 567 | 188 | 222 |

NB: Visit http://www.cedefop.europa.eu/EN/about-cedefop/projects/forecasting-skill-demand-and-supply/skills-forecasts.aspx for possible updates of this table.
*Source*: Cedefop (IER estimates).

Table 7 **Labour force (15+) by country and qualification, 2000-20**

| | All qualifications | | | | | Low qualifications | | | | | Medium qualifications | | | | | High qualifications | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Levels (000s) | | | Change 000s | | Levels (000s) | | | Change 000s | | Levels (000s) | | | Change 000s | | Levels (000s) | | | Change 000s | |
| | 2000 | 2010 | 2020 | 2000-10 | 2010-20 | 2000 | 2010 | 2020 | 2000-10 | 2010-20 | 2000 | 2010 | 2020 | 2000-10 | 2010-20 | 2000 | 2010 | 2020 | 2000-10 | 2010-20 |
| BE | 4 410 | 4 900 | 5 162 | 490 | 262 | 1 410 | 1 054 | 720 | - 356 | - 334 | 1 563 | 1 955 | 2 179 | 392 | 224 | 1 438 | 1 891 | 2 263 | 453 | 372 |
| BG | 3 428 | 3 380 | 3 239 | - 48 | - 141 | 861 | 590 | 384 | - 272 | - 206 | 1 742 | 1 807 | 1 791 | 65 | - 16 | 825 | 983 | 1 064 | 158 | 81 |
| CZ | 5 124 | 5 273 | 5 403 | 149 | 130 | 665 | 398 | 209 | - 268 | - 188 | 3 654 | 3 688 | 3 457 | 34 | - 231 | 805 | 1 188 | 1 737 | 383 | 549 |
| DK | 2 844 | 2 924 | 3 017 | 80 | 93 | 629 | 677 | 704 | 49 | 26 | 1 437 | 1 169 | 1 013 | - 269 | - 156 | 777 | 1 078 | 1 301 | 300 | 223 |
| DE | 39 447 | 41 669 | 40 953 | 2 222 | - 716 | 7 187 | 6 072 | 4 973 | -1 115 | -1 099 | 22 793 | 24 576 | 23 965 | 1 783 | - 611 | 9 467 | 11 021 | 12 015 | 1 554 | 994 |
| EE | 652 | 687 | 677 | 35 | - 10 | 109 | 75 | 57 | - 34 | - 19 | 349 | 346 | 322 | - 3 | - 25 | 194 | 266 | 299 | 72 | 33 |
| IE | 1 747 | 2 135 | 2 135 | 388 | 0 | 608 | 467 | 309 | - 141 | - 158 | 689 | 829 | 872 | 141 | 42 | 450 | 838 | 954 | 388 | 116 |
| EL | 4 617 | 5 008 | 5 141 | 390 | 133 | 1 944 | 1 633 | 1 197 | - 311 | - 436 | 1 734 | 1 955 | 2 175 | 221 | 220 | 940 | 1 420 | 1 769 | 480 | 349 |
| ES | 17 909 | 23 110 | 23 049 | 5 201 | - 60 | 9 698 | 9 317 | 5 657 | - 380 | -3 661 | 3 460 | 5 862 | 7 629 | 2 402 | 1 767 | 4 751 | 7 930 | 9 764 | 3 179 | 1 834 |
| FR | 25 755 | 28 396 | 30 278 | 2 641 | 1 882 | 8 178 | 6 674 | 5 312 | -1 504 | -1 362 | 10 994 | 12 132 | 12 562 | 1 138 | 430 | 6 583 | 9 590 | 12 404 | 3 007 | 2 814 |
| IT | 23 475 | 24 965 | 25 761 | 1 490 | 796 | 11 077 | 9 038 | 6 737 | -2 039 | -2 301 | 9 401 | 11 238 | 12 719 | 1 836 | 1 481 | 2 996 | 4 689 | 6 305 | 1 693 | 1 616 |
| CY | 309 | 409 | 457 | 99 | 49 | 109 | 98 | 72 | - 11 | - 26 | 111 | 154 | 181 | 43 | 27 | 89 | 156 | 204 | 67 | 48 |
| LV | 1 098 | 1 157 | 1 152 | 59 | - 5 | 193 | 134 | 97 | - 60 | - 37 | 651 | 651 | 575 | 0 | - 76 | 254 | 373 | 481 | 119 | 108 |
| LI | 1 688 | 1 644 | 1 618 | - 44 | - 26 | 277 | 108 | 64 | - 169 | - 43 | 776 | 869 | 867 | 93 | - 2 | 635 | 667 | 687 | 32 | 20 |
| LU | 185 | 231 | 260 | 46 | 29 | 63 | 49 | 30 | - 14 | - 19 | 80 | 95 | 113 | 15 | 18 | 42 | 87 | 117 | 45 | 30 |
| HU | 4 074 | 4 246 | 4 300 | 172 | 54 | 803 | 555 | 283 | - 248 | - 271 | 2 440 | 2 442 | 2 284 | 2 | - 157 | 832 | 1 250 | 1 732 | 418 | 482 |
| MT | 151 | 174 | 171 | 23 | - 3 | 100 | 87 | 54 | - 12 | - 33 | 28 | 41 | 54 | 13 | 13 | 23 | 45 | 62 | 22 | 17 |
| NL | 8 080 | 8 744 | 9 153 | 664 | 409 | 2 527 | 2 118 | 1 481 | - 409 | - 637 | 3 556 | 3 589 | 3 585 | 33 | - 4 | 1 997 | 3 037 | 4 087 | 1 040 | 1 050 |
| AT | 3 865 | 4 284 | 4 438 | 419 | 155 | 835 | 746 | 575 | - 88 | - 171 | 2 424 | 2 554 | 2 378 | 130 | - 176 | 606 | 983 | 1 486 | 378 | 502 |
| PL | 17 348 | 17 579 | 17 582 | 231 | 4 | 3 005 | 2 428 | 1 639 | - 577 | - 789 | 10 694 | 10 064 | 8 540 | - 630 | -1 524 | 3 648 | 5 086 | 7 402 | 1 438 | 2 316 |
| PT | 5 201 | 5 597 | 5 633 | 395 | 36 | 3 816 | 3 371 | 2 846 | - 445 | - 524 | 703 | 1 053 | 1 331 | 350 | 278 | 683 | 1 173 | 1 455 | 491 | 282 |
| RO | 10 258 | 9 967 | 9 997 | - 291 | 30 | 2 377 | 2 371 | 1 828 | - 6 | - 543 | 7 411 | 5 436 | 4 467 | -1 975 | - 969 | 470 | 2 160 | 3 702 | 1 691 | 1 542 |
| SI | 956 | 1 046 | 1 046 | 90 | 1 | 231 | 177 | 125 | - 54 | - 52 | 534 | 552 | 515 | 18 | - 37 | 190 | 316 | 406 | 126 | 90 |
| SK | 2 574 | 2 705 | 2 794 | 131 | 89 | 338 | 214 | 125 | - 124 | - 89 | 1 865 | 1 873 | 1 801 | 8 | - 72 | 371 | 618 | 868 | 247 | 250 |
| FI | 2 664 | 2 671 | 2 658 | 8 | - 14 | 725 | 413 | 225 | - 312 | - 188 | 1 136 | 1 165 | 1 050 | 30 | - 116 | 803 | 1 094 | 1 383 | 290 | 289 |
| SE | 4 364 | 4 968 | 5 212 | 604 | 244 | 928 | 866 | 642 | - 62 | - 223 | 2 137 | 2 293 | 2 238 | 156 | - 54 | 1 299 | 1 810 | 2 331 | 510 | 522 |
| UK | 28 870 | 31 422 | 32 493 | 2 553 | 1 071 | 9 600 | 6 757 | 3 812 | -2 844 | -2 945 | 11 455 | 13 713 | 15 495 | 2 258 | 1 782 | 7 814 | 10 953 | 13 187 | 3 138 | 2 234 |
| EU-27 | 221 092 | 239 291 | 243 781 | 18 199 | 4 490 | 68 293 | 56 486 | 40 159 | -11 807 | -16 328 | 103 817 | 112 103 | 114 157 | 8 286 | 2 054 | 48 982 | 70 702 | 89 465 | 21 720 | 18 764 |
| NO | 2 353 | 2 587 | 2 864 | 235 | 277 | 376 | 400 | 403 | 23 | 3 | 1 195 | 1 076 | 966 | - 120 | - 110 | 781 | 1 112 | 1 495 | 331 | 383 |
| CH | 3 938 | 4 493 | 4 981 | 555 | 488 | 890 | 768 | 648 | - 122 | - 119 | 2 120 | 2 196 | 2 104 | 76 | - 92 | 928 | 1 530 | 2 228 | 602 | 698 |
| EU-27+ | 227 383 | 246 371 | 251 626 | 18 989 | 5 254 | 69 560 | 57 654 | 41 210 | -11 906 | -16 444 | 107 132 | 115 374 | 117 227 | 8 242 | 1 853 | 50 691 | 73 344 | 93 189 | 22 653 | 19 845 |

NB: Visit http://www.cedefop.europa.eu/EN/about-cedefop/projects/forecasting-skill-demand-and-supply/skills-forecasts.aspx for possible updates of this table.
*Source*: Cedefop (IER estimates).

Table 8 **Participation (activity) rates by gender, age group and qualification, 2000-20, EU-27+**

| | All qualifications | | | Low qualifications | | | Medium qualifications | | | High qualifications | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2000 | 2010 | 2020 | 2000 | 2010 | 2020 | 2000 | 2010 | 2020 | 2000 | 2010 | 2020 |
| **Males and females** | | | | | | | | | | | | |
| 15+ | 55.6 | 56.8 | 56.4 | 37.6 | 35.4 | 30.6 | 66.8 | 64.8 | 61.8 | 79.4 | 79.3 | 76.7 |
| 15-19 | 24.7 | 21.9 | 22.1 | 20.3 | 17.4 | 17.7 | 41.9 | 36.9 | 34.2 | 41.9 | 44.2 | 35.2 |
| 20-24 | 61.9 | 60.5 | 61.7 | 69.0 | 67.5 | 69.2 | 58.0 | 56.2 | 57.5 | 68.5 | 68.7 | 67.3 |
| 25-29 | 79.4 | 81.1 | 83.5 | 72.4 | 72.7 | 75.3 | 78.8 | 79.9 | 82.3 | 87.6 | 87.0 | 87.0 |
| 30-34 | 83.6 | 84.6 | 87.2 | 74.4 | 74.5 | 76.3 | 85.3 | 84.2 | 86.2 | 90.8 | 90.8 | 90.9 |
| 35-39 | 84.2 | 85.5 | 87.7 | 74.8 | 75.8 | 78.0 | 86.7 | 86.1 | 87.1 | 91.6 | 91.8 | 92.0 |
| 40-44 | 84.9 | 86.6 | 88.2 | 74.3 | 76.1 | 78.5 | 88.4 | 88.1 | 88.4 | 93.5 | 93.4 | 93.1 |
| 45-49 | 82.8 | 85.4 | 87.1 | 72.4 | 75.1 | 77.4 | 86.6 | 86.8 | 86.9 | 93.3 | 93.7 | 93.4 |
| 50-54 | 75.9 | 80.5 | 83.2 | 64.1 | 69.6 | 71.9 | 81.4 | 81.4 | 82.1 | 91.7 | 92.0 | 91.4 |
| 55-59 | 55.3 | 65.6 | 70.2 | 45.8 | 53.2 | 55.2 | 58.0 | 66.2 | 68.5 | 76.4 | 83.6 | 83.4 |
| 60-64 | 23.8 | 33.3 | 36.3 | 19.8 | 23.8 | 24.6 | 23.1 | 34.1 | 34.0 | 44.4 | 55.5 | 53.1 |
| 65+ | 3.6 | 4.8 | 5.5 | 2.6 | 3.1 | 3.3 | 4.6 | 5.6 | 6.3 | 11.0 | 13.1 | 12.2 |
| **Males** | | | | | | | | | | | | |
| 15+ | 64.7 | 64.1 | 63.5 | 49.5 | 45.7 | 41.4 | 72.9 | 70.6 | 68.5 | 81.3 | 80.6 | 78.7 |
| 15-19 | 26.6 | 23.4 | 23.5 | 22.8 | 19.3 | 19.3 | 43.3 | 38.8 | 36.4 | 41.8 | 44.6 | 35.6 |
| 20-24 | 65.2 | 64.5 | 64.6 | 76.9 | 75.1 | 75.5 | 60.3 | 60.0 | 60.4 | 66.1 | 68.2 | 66.6 |
| 25-29 | 86.3 | 86.5 | 87.5 | 86.4 | 84.3 | 85.5 | 84.9 | 85.9 | 87.5 | 89.3 | 88.8 | 88.4 |
| 30-34 | 92.6 | 91.9 | 93.8 | 90.1 | 86.6 | 87.6 | 93.2 | 92.2 | 94.0 | 94.2 | 95.0 | 95.8 |
| 35-39 | 93.3 | 92.3 | 93.9 | 89.6 | 87.4 | 88.6 | 94.1 | 92.8 | 94.1 | 96.3 | 95.3 | 96.1 |
| 40-44 | 93.3 | 92.8 | 93.9 | 89.4 | 86.7 | 87.7 | 93.8 | 93.6 | 94.6 | 97.2 | 96.9 | 96.9 |
| 45-49 | 91.7 | 91.0 | 93.1 | 87.1 | 86.1 | 87.7 | 92.6 | 91.2 | 93.1 | 96.5 | 95.8 | 96.8 |
| 50-54 | 86.9 | 87.2 | 89.9 | 81.8 | 82.6 | 84.7 | 87.3 | 86.2 | 88.7 | 95.2 | 94.1 | 95.3 |
| 55-59 | 68.1 | 74.9 | 80.1 | 60.4 | 65.7 | 68.0 | 68.1 | 73.6 | 78.1 | 83.5 | 88.3 | 90.7 |
| 60-64 | 33.7 | 41.9 | 45.6 | 30.2 | 31.9 | 33.8 | 30.5 | 40.5 | 41.4 | 51.4 | 62.5 | 62.9 |
| 65+ | 5.7 | 7.0 | 7.7 | 4.1 | 4.5 | 4.6 | 6.5 | 7.5 | 8.4 | 13.1 | 15.3 | 14.5 |
| **Females** | | | | | | | | | | | | |
| 15+ | 47.1 | 50.0 | 49.8 | 28.5 | 27.0 | 21.3 | 60.4 | 58.9 | 54.9 | 77.2 | 78.1 | 74.8 |
| 15-19 | 22.7 | 20.2 | 20.6 | 17.6 | 15.3 | 15.9 | 40.7 | 35.2 | 32.3 | 42.0 | 43.8 | 34.6 |
| 20-24 | 58.5 | 56.5 | 58.6 | 59.0 | 57.7 | 60.0 | 55.7 | 52.3 | 54.4 | 70.3 | 69.1 | 67.8 |
| 25-29 | 72.5 | 75.6 | 79.4 | 57.6 | 57.9 | 59.6 | 72.2 | 72.9 | 75.4 | 86.0 | 85.6 | 86.0 |
| 30-34 | 74.4 | 77.1 | 80.3 | 58.6 | 60.1 | 60.8 | 77.0 | 75.2 | 76.5 | 87.4 | 87.2 | 86.9 |
| 35-39 | 75.0 | 78.7 | 81.3 | 60.9 | 62.9 | 63.1 | 79.0 | 79.0 | 79.4 | 86.5 | 88.7 | 88.5 |
| 40-44 | 76.6 | 80.3 | 82.4 | 61.8 | 65.0 | 65.2 | 82.5 | 82.5 | 82.3 | 89.4 | 90.0 | 89.7 |
| 45-49 | 73.9 | 79.7 | 81.1 | 60.8 | 64.9 | 64.1 | 79.8 | 82.3 | 80.7 | 89.6 | 91.6 | 90.3 |
| 50-54 | 65.0 | 73.9 | 76.5 | 50.9 | 59.0 | 58.5 | 74.6 | 76.2 | 75.0 | 87.1 | 89.8 | 88.0 |
| 55-59 | 43.0 | 56.8 | 60.6 | 35.4 | 44.0 | 44.2 | 46.8 | 58.7 | 59.3 | 65.3 | 77.7 | 75.5 |
| 60-64 | 14.8 | 25.4 | 27.7 | 12.5 | 18.0 | 17.8 | 14.8 | 27.2 | 26.7 | 32.1 | 46.1 | 42.3 |
| 65+ | 2.1 | 3.2 | 3.7 | 1.7 | 2.3 | 2.6 | 2.8 | 3.9 | 4.3 | 7.6 | 9.6 | 9.0 |

NB: Visit http://www.cedefop.europa.eu/EN/about-cedefop/projects/forecasting-skill-demand-and-supply/skills-forecasts.aspx for possible updates of this table.
*Source*: Cedefop (IER estimates).

Table 9 **Employment trends by industry, 2000-20, EU- 27+**

| | Levels (000s) | | | Changes (000S) | | Shares (%) | | | Growth p.a. (%) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2000 | 2010 | 2020 | 2000-10 | 2010-20 | 2000 | 2010 | 2020 | 2000-10 | 2010-20 |
| Primary sector and utilities | 19 794 | 14 653 | 13 167 | -5 141 | -1 487 | 9.1 | 6.4 | 5.5 | -2.6 | -1.0 |
| Agriculture, etc. | 16 944 | 12 172 | 10 933 | -4 772 | -1 239 | 7.8 | 5.3 | 4.6 | -2.8 | -1.0 |
| Mining and quarrying | 983 | 777 | 623 | - 206 | - 154 | 0.4 | 0.3 | 0.3 | -2.1 | -2.0 |
| Electricity, gas and water | 1 867 | 1 705 | 1 611 | - 162 | - 94 | 0.9 | 0.7 | 0.7 | -0.9 | -0.6 |
| Manufacturing | 39 943 | 34 948 | 34 492 | -4 995 | - 456 | 18.3 | 15.2 | 14.5 | -1.3 | -0.1 |
| Food, drink and tobacco | 5 245 | 4 743 | 4 748 | - 503 | 5 | 2.4 | 2.1 | 2.0 | -1.0 | 0.0 |
| Engineering | 8 319 | 7 467 | 7 705 | - 852 | 238 | 3.8 | 3.2 | 3.2 | -1.0 | 0.3 |
| Rest of manufacturing | 26 379 | 22 739 | 22 039 | -3 640 | - 700 | 12.1 | 9.9 | 9.2 | -1.4 | -0.3 |
| Construction | 15 055 | 16 152 | 16 367 | 1 096 | 216 | 6.9 | 7.0 | 6.9 | 0.7 | 0.1 |
| Distribution and transport | 54 434 | 58 710 | 62 196 | 4 275 | 3 487 | 24.9 | 25.5 | 26.1 | 0.8 | 0.6 |
| Distribution | 32 304 | 34 570 | 36 561 | 2 266 | 1 991 | 14.8 | 15.0 | 15.3 | 0.7 | 0.6 |
| Hotels and catering | 9 160 | 10 750 | 11 745 | 1 590 | 995 | 4.2 | 4.7 | 4.9 | 1.7 | 0.9 |
| Transport and telecommunications | 12 971 | 13 389 | 13 890 | 419 | 501 | 5.9 | 5.8 | 5.8 | 0.3 | 0.4 |
| Business and other services | 41 878 | 51 560 | 57 280 | 9 683 | 5 720 | 19.2 | 22.4 | 24.0 | 2.3 | 1.1 |
| Banking and insurance | 6 086 | 6 128 | 6 440 | 42 | 312 | 2.8 | 2.7 | 2.7 | 0.1 | 0.5 |
| Other business services | 22 865 | 29 979 | 34 165 | 7 114 | 4 186 | 10.5 | 13.0 | 14.3 | 3.1 | 1.4 |
| Miscellaneous services | 12 926 | 15 453 | 16 676 | 2 527 | 1 222 | 5.9 | 6.7 | 7.0 | 2.0 | 0.8 |
| Non-marketed services | 47 426 | 54 285 | 55 182 | 6 859 | 897 | 21.7 | 23.6 | 23.1 | 1.4 | 0.2 |
| Public admin and defence | 14 562 | 15 215 | 14 601 | 652 | - 613 | 6.7 | 6.6 | 6.1 | 0.4 | -0.4 |
| Education | 14 098 | 15 958 | 16 212 | 1 859 | 254 | 6.5 | 6.9 | 6.8 | 1.3 | 0.2 |
| Health and social work | 18 765 | 23 113 | 24 369 | 4 347 | 1 256 | 8.6 | 10.0 | 10.2 | 2.3 | 0.5 |
| All industries | 218 530 | 230 308 | 238 684 | 11 778 | 8 377 | 100.0 | 100.0 | 100.0 | 0.5 | 0.4 |

NB: Visit http://www.cedefop.europa.eu/EN/about-cedefop/projects/forecasting-skill-demand-and-supply/skills-forecasts.aspx for possible updates of this table.
*Source*: Cedefop (IER estimates).

Table 10 **Employment trends by occupation, 2000-20, EU-27+**

| | Absolute levels and changes (000s) | | | | | Annual growth and occupation shares (%) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Levels (000s) | | | Changes (000S) | | Shares (%) | | | Growth p.a. (%) | |
| | 2000 | 2010 | 2020 | 2000-10 | 2010-20 | 2000 | 2010 | 2020 | 2000-10 | 2010-20 |
| **Legislators, senior officials and managers** | **17 870** | **19 444** | **21 000** | **1 574** | **1 556** | **8.2** | **8.4** | **8.8** | **0.7** | **0.8** |
| 11 Legislators and senior officials | 540 | 408 | 434 | - 132 | 27 | 3.0 | 2.1 | 2.1 | 0.2 | 0.6 |
| 12 Corporate managers | 9 806 | 11 019 | 12 035 | 1 213 | 1 016 | 54.9 | 56.7 | 57.3 | 0.9 | 0.9 |
| 13 Managers of small enterprises | 7 523 | 8 017 | 8 530 | 494 | 513 | 42.1 | 41.2 | 40.6 | 0.5 | 0.6 |
| **Professionals** | **28 312** | **34 242** | **37 061** | **5 930** | **2 819** | **13.0** | **14.9** | **15.5** | **0.8** | **0.8** |
| 21 Physical, mathematical and engineering science professionals | 7 028 | 8 687 | 9 925 | 1 660 | 1 237 | 24.8 | 25.4 | 26.8 | 1.4 | 1.3 |
| 22 Life science and health professionals | 3 839 | 4 243 | 4 198 | 404 | - 45 | 13.6 | 12.4 | 11.3 | -0.2 | -0.1 |
| 23 Teaching professionals | 8 388 | 9 129 | 8 470 | 741 | - 659 | 29.6 | 26.7 | 22.9 | -0.7 | -0.7 |
| 24 Other professionals | 9 057 | 12 183 | 14 469 | 3 126 | 2 286 | 32.0 | 35.6 | 39.0 | 1.9 | 1.7 |
| **Technicians and associate professionals** | **32 459** | **38 646** | **43 658** | **6 187** | **5 012** | **14.9** | **16.8** | **18.3** | **1.3** | **1.2** |
| 31 Physical and engineering science associate professionals | 7 817 | 8 691 | 9 246 | 874 | 555 | 24.1 | 22.5 | 21.2 | 0.6 | 0.6 |
| 32 Life science and health associate professionals | 5 291 | 6 411 | 7 138 | 1 120 | 727 | 16.3 | 16.6 | 16.4 | 1.2 | 1.1 |
| 33 Teaching associate professionals | 2 470 | 2 950 | 3 647 | 480 | 697 | 7.6 | 7.6 | 8.4 | 2.5 | 2.1 |
| 34 Other associate professionals | 16 881 | 20 595 | 23 626 | 3 714 | 3 032 | 52.0 | 53.3 | 54.1 | 1.5 | 1.4 |
| **Clerks** | **25 602** | **24 361** | **22 575** | **-1 242** | **-1 786** | **11.7** | **10.6** | **9.5** | **-0.8** | **-0.8** |
| 41 Office clerks | 21 439 | 19 646 | 16 798 | -1 793 | -2 847 | 83.7 | 80.6 | 74.4 | -1.5 | -1.6 |
| 42 Customer services clerks | 4 163 | 4 715 | 5 776 | 552 | 1 061 | 16.3 | 19.4 | 25.6 | 1.8 | 2.1 |
| **Service workers and shop and market sales workers** | **28 156** | **32 344** | **33 514** | **4 188** | **1 170** | **12.9** | **14.0** | **14.0** | **0.5** | **0.4** |
| 51 Personal and protective services workers | 17 720 | 20 957 | 21 511 | 3 237 | 554 | 62.9 | 64.8 | 64.2 | 0.4 | 0.3 |
| 52 Models, salespersons and demonstrators | 10 436 | 11 387 | 12 003 | 951 | 616 | 37.1 | 35.2 | 35.8 | 0.6 | 0.5 |
| **Skilled agricultural and fishery workers** | **13 218** | **9 652** | **8 747** | **-3 566** | **- 905** | **6.0** | **4.2** | **3.7** | **-1.0** | **-1.0** |
| 61 Skilled agricultural and fishery workers | 13 218 | 9 652 | 8 747 | -3 566 | - 905 | 6.0 | 4.2 | 3.7 | -1.0 | -1.0 |
| **Craft and related trades workers** | **31 627** | **29 182** | **27 438** | **-2 445** | **-1 744** | **14.5** | **12.7** | **11.5** | **-0.8** | **-0.6** |
| 71 Extraction and building trades workers | 11 703 | 12 964 | 13 614 | 1 260 | 650 | 37.0 | 44.4 | 49.6 | 0.3 | 0.5 |
| 72 Metal, machinery and related trades workers | 12 500 | 10 825 | 9 250 | -1 675 | -1 575 | 39.5 | 37.1 | 33.7 | -1.7 | -1.6 |
| 73 Precision, handicraft, craft printing and related trades workers | 1 784 | 1 192 | 1 002 | - 591 | - 190 | 5.6 | 4.1 | 3.7 | -2.3 | -1.7 |
| 74 Other craft and related trades workers | 5 640 | 4 201 | 3 571 | -1 439 | - 630 | 17.8 | 14.4 | 13.0 | -1.6 | -1.6 |
| **Plant and machine operators and assemblers** | **18 754** | **17 847** | **17 825** | **- 907** | **- 22** | **8.6** | **7.7** | **7.5** | **0.1** | **0.0** |
| 81 Stationary plant and related operators | 2 236 | 2 036 | 2 174 | - 200 | 137 | 11.9 | 11.4 | 12.2 | 0.7 | 0.7 |
| 82 Machine operators and assemblers | 7 383 | 6 386 | 6 456 | - 997 | 70 | 39.4 | 35.8 | 36.2 | 0.3 | 0.1 |
| 83 Drivers and mobile plant operators | 9 136 | 9 425 | 9 196 | 290 | - 229 | 48.7 | 52.8 | 51.6 | -0.1 | -0.2 |

| | Absolute levels and changes (000s) | | | | | Annual growth and occupation shares (%) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Levels (000s) | | | Changes (000S) | | Shares (%) | | | Growth p.a. (%) | |
| | 2000 | 2010 | 2020 | 2000-10 | 2010-20 | 2000 | 2010 | 2020 | 2000-10 | 2010-20 |
| **Elementary occupations** | **21 165** | **23 358** | **25 858** | **2 193** | **2 500** | **9.7** | **10.1** | **10.8** | **1.0** | **1.0** |
| 91 Sales and services elementary occupations | 13 194 | 15 168 | 16 188 | 1 974 | 1 020 | 62.3 | 64.9 | 62.6 | 0.7 | 0.7 |
| 92 Agricultural, fishery and related labourers | 2 033 | 1 839 | 2 106 | - 194 | 267 | 9.6 | 7.9 | 8.1 | 1.3 | 1.4 |
| 93 Labourers in mining, construction, manufacturing and transport | 5 938 | 6 351 | 7 564 | 413 | 1 213 | 28.1 | 27.2 | 29.3 | 1.6 | 1.8 |
| **All industries** | **218 530** | **230 308** | **238 684** | **11 778** | **8 377** | **100.0** | **100.0** | **100.0** | **0.4** | **0.4** |

NB: Visit http://www.cedefop.europa.eu/EN/about-cedefop/projects/forecasting-skill-demand-and-supply/skills-forecasts.aspx for possible updates of this table.
All occupations including ISCO 0 Armed forces.
*Source*: Cedefop (IER estimates).

Table 11 **Employment change by occupation minor group, 2010-20**

| | Levels (000s) | | Change | Share (%) | |
|---|---|---|---|---|---|
| | 2010 | 2020 | 2010-20 | 2010 | 2020 |
| **11 Legislators and senior officials** | **408** | **434** | **27** | **0.18** | **0.18** |
| 110 Other: legislators and senior officials | 0 | 0 | 0 | 0.00 | 0.00 |
| 111 Legislators | 204 | 204 | 0 | 0.09 | 0.09 |
| 112 Senior government officials | 0 | 0 | 0 | 0.00 | 0.00 |
| 113 Traditional chiefs and heads of villages | 0 | 0 | 0 | 0.00 | 0.00 |
| 114 Senior officials of special-interest organisations | 203 | 230 | 27 | 0.09 | 0.10 |
| **12 Corporate managers** | **11 019** | **12 035** | **1 016** | **4.78** | **5.04** |
| 120 Other: corporate managers | 2 124 | 2 382 | 258 | 0.92 | 1.00 |
| 121 Directors and chief executives | 3 097 | 3 385 | 288 | 1.34 | 1.42 |
| 122 Production and operations department managers | 2 719 | 2 964 | 245 | 1.18 | 1.24 |
| 123 Other department managers | 3 078 | 3 304 | 225 | 1.34 | 1.38 |
| **13 Managers of small enterprises** | **8 017** | **8 530** | **513** | **3.48** | **3.57** |
| 130 Other: managers of small enterprises | 2 574 | 2 920 | 347 | 1.12 | 1.22 |
| 131 General managers | 5 443 | 5 610 | 166 | 2.36 | 2.35 |
| **21 Physical, mathematical and engineering science professionals** | **8 687** | **9 925** | **1 237** | **3.77** | **4.16** |
| 210 Other: physical, mathematical and engineering science professionals | 0 | 0 | 0 | 0.00 | 0.00 |
| 211 Physicists; chemists and related professionals | 623 | 731 | 108 | 0.27 | 0.31 |
| 212 Mathematicians; statisticians and related professionals | 186 | 227 | 42 | 0.08 | 0.10 |
| 213 Computing professionals | 2 065 | 2 342 | 277 | 0.90 | 0.98 |
| 214 Architects; engineers and related professionals | 5 814 | 6 625 | 811 | 2.52 | 2.78 |
| **22 Life science and health professionals** | **4 243** | **4 198** | **- 45** | **1.84** | **1.76** |
| 220 Other: life science and health professionals | 0 | 0 | 0 | 0.00 | 0.00 |
| 221 Life science professionals | 353 | 386 | 34 | 0.15 | 0.16 |
| 222 Health professionals (except nursing) | 3 891 | 3 812 | - 79 | 1.69 | 1.60 |
| 223 Nursing and midw ifery professionals | 0 | 0 | 0 | 0.00 | 0.00 |
| **23 Teaching professionals** | **9 129** | **8 470** | **- 659** | **3.96** | **3.55** |
| 230 Other: teaching professionals | 0 | 0 | 0 | 0.00 | 0.00 |
| 231 College; university and higher education teaching professionals | 1 109 | 1 034 | - 74 | 0.48 | 0.43 |
| 232 Secondary education teaching professionals | 5 522 | 5 081 | - 442 | 2.40 | 2.13 |
| 233 Primary and pre-primary education teaching professionals | 1 139 | 1 045 | - 95 | 0.49 | 0.44 |
| 234 Special education teaching professionals | 475 | 439 | - 36 | 0.21 | 0.18 |
| 235 Other teaching professionals | 883 | 870 | - 13 | 0.38 | 0.36 |

| | | | | | |
|---|---|---|---|---|---|
| **24 Other professionals** | **12 183** | **14 469** | **2 286** | **5.29** | **6.06** |
| 240 Other: other professionals | 0 | 0 | 0 | 0.00 | 0.00 |
| 241 Business professionals | 3 426 | 4 228 | 803 | 1.49 | 1.77 |
| 242 Legal professionals | 1 513 | 1 701 | 188 | 0.66 | 0.71 |
| 243 Archivists; librarians and related information professionals | 374 | 427 | 53 | 0.16 | 0.18 |
| 244 Social science and related professionals | 3 017 | 3 748 | 732 | 1.31 | 1.57 |
| 245 Writers and creative or performing artists | 1 588 | 1 801 | 212 | 0.69 | 0.75 |
| 246 Religious professionals | 337 | 371 | 34 | 0.15 | 0.16 |
| 247 Public service administrative professionals | 1 928 | 2 192 | 265 | 0.84 | 0.92 |
| **31 Physical and engineering science associate professionals** | **8 691** | **9 246** | **555** | **3.77** | **3.87** |
| 310 Other: physical and engineering science associate professionals | 0 | 0 | 0 | 0.00 | 0.00 |
| 311 Physical and engineering science technicians | 5 140 | 5 531 | 391 | 2.23 | 2.32 |
| 312 Computer associate professionals | 1 601 | 1 594 | - 7 | 0.70 | 0.67 |
| 313 Optical and electronic equipment operators | 525 | 544 | 20 | 0.23 | 0.23 |
| 314 Ship and aircraft controllers and technicians | 202 | 209 | 7 | 0.09 | 0.09 |
| 315 Safety and quality inspectors | 1 224 | 1 368 | 144 | 0.53 | 0.57 |
| **32 Life science and health associate professionals** | **6 411** | **7 138** | **727** | **2.78** | **2.99** |
| 320 Other: life science and health associate professionals | 0 | 0 | 0 | 0.00 | 0.00 |
| 321 Life science technicians and related associate professionals | 762 | 979 | 217 | 0.33 | 0.41 |
| 322 Modern health associate professionals (except nursing) | 1 862 | 2 307 | 446 | 0.81 | 0.97 |
| 323 Nursing and midw ifery associate professionals | 3 787 | 3 852 | 64 | 1.64 | 1.61 |
| 324 Traditional medicine practitioners and faith healers | 0 | 0 | 0 | 0.00 | 0.00 |
| **33 Teaching associate professionals** | **2 950** | **3 647** | **697** | **1.28** | **1.53** |
| 330 Other: teaching associate professionals | 0 | 0 | 0 | 0.00 | 0.00 |
| 331 Primary education teaching associate professionals | 0 | 0 | 0 | 0.00 | 0.00 |
| 332 Pre-primary education teaching associate professionals | 2 036 | 2 521 | 485 | 0.88 | 1.06 |
| 333 Special education teaching associate professionals | 200 | 268 | 68 | 0.09 | 0.11 |
| 334 Other teaching associate professionals | 714 | 859 | 145 | 0.31 | 0.36 |
| **34 Other associate professionals** | **20 595** | **23 626** | **3 032** | **8.94** | **9.90** |
| 340 Other: other associate professionals | 0 | 0 | 0 | 0.00 | 0.00 |
| 341 Finance and sales associate professionals | 5 417 | 6 242 | 826 | 2.35 | 2.62 |
| 342 Business services agents and trade brokers | 1 350 | 1 474 | 124 | 0.59 | 0.62 |
| 343 Administrative associate professionals | 6 691 | 7 472 | 781 | 2.91 | 3.13 |
| 344 Customs; tax and related government associate professionals | 3 393 | 3 867 | 474 | 1.47 | 1.62 |
| 345 Police inspectors and detectives | 333 | 370 | 36 | 0.14 | 0.15 |
| 346 Social w ork associate professionals | 1 971 | 2 612 | 641 | 0.86 | 1.09 |
| 347 Artistic; entertainment and sports associate professionals | 1 304 | 1 433 | 129 | 0.57 | 0.60 |
| 348 Religious associate professionals | 136 | 155 | 20 | 0.06 | 0.07 |
| **41 Office clerks** | **19 646** | **16 798** | **-2 847** | **8.53** | **7.04** |

| | | | | | |
|---|---|---|---|---|---|
| 410 Other: office clerks | 0 | 0 | 0 | 0.00 | 0.00 |
| 411 Secretaries and keyboard-operating clerks | 2 995 | 2 491 | - 503 | 1.30 | 1.04 |
| 412 Numerical clerks | 3 509 | 2 881 | - 628 | 1.52 | 1.21 |
| 413 Material-recording and transport clerks | 3 452 | 3 169 | - 283 | 1.50 | 1.33 |
| 414 Library; mail and related clerks | 1 092 | 904 | - 188 | 0.47 | 0.38 |
| 419 Other office clerks | 8 598 | 7 353 | -1 245 | 3.73 | 3.08 |
| **42 Customer services clerks** | **4 715** | **5 776** | **1 061** | **2.05** | **2.42** |
| 420 Other: customer services clerks | 0 | 0 | 0 | 0.00 | 0.00 |
| 421 Cashiers; tellers and related clerks | 2 342 | 2 685 | 344 | 1.02 | 1.13 |
| 422 Client information clerks | 2 373 | 3 091 | 718 | 1.03 | 1.29 |
| **51 Personal and protective services workers** | **20 957** | **21 511** | **554** | **9.10** | **9.01** |
| 510 Other: personal and protective services w orkers | 0 | 0 | 0 | 0.00 | 0.00 |
| 511 Travel attendants and related w orkers | 307 | 299 | - 8 | 0.13 | 0.13 |
| 512 Housekeeping and restaurant services w orkers | 9 101 | 9 476 | 376 | 3.95 | 3.97 |
| 513 Personal care and related w orkers | 5 994 | 5 949 | - 45 | 2.60 | 2.49 |
| 514 Other personal services w orkers | 3 511 | 3 809 | 298 | 1.52 | 1.60 |
| 515 Astrologers; rortune-tellers and related w orkers | 0 | 0 | 0 | 0.00 | 0.00 |
| 516 Protective services w orkers | 2 045 | 1 978 | - 66 | 0.89 | 0.83 |
| **52 Models, salespersons and demonstrators** | **11 387** | **12 003** | **616** | **4.94** | **5.03** |
| 520 Other: models, salespersons and demonstrators | 0 | 0 | 0 | 0.00 | 0.00 |
| 521 Fashion and other models | 29 | 40 | 11 | 0.01 | 0.02 |
| 522 Shop salespersons and demonstrators | 11 358 | 11 963 | 605 | 4.93 | 5.01 |
| 523 Stall and market salespersons | 0 | 0 | 0 | 0.00 | 0.00 |
| **61 Skilled agricultural and fishery workers** | **9 652** | **8 747** | **- 905** | **4.19** | **3.66** |
| 610 Other: skilled agricultural and fishery w orkers | 3 560 | 3 174 | - 386 | 1.55 | 1.33 |
| 611 Market gardeners and crop grow ers | 4 336 | 3 946 | - 390 | 1.88 | 1.65 |
| 612 Market-oriented animal producers and related w orkers | 962 | 928 | - 34 | 0.42 | 0.39 |
| 613 Market-oriented crop and animal producers | 0 | 0 | 0 | 0.00 | 0.00 |
| 614 Forestry and related w orkers | 674 | 593 | - 81 | 0.29 | 0.25 |
| 615 Fishery w orkers; hunters and trappers | 120 | 106 | - 14 | 0.05 | 0.04 |
| **71 Extraction and building trades workers** | **12 964** | **13 614** | **650** | **5.63** | **5.70** |
| 710 Other: extraction and building trades w orkers | 0 | 0 | 0 | 0.00 | 0.00 |
| 711 Miners; shotfirers; stone cutters and carvers | 461 | 380 | - 81 | 0.20 | 0.16 |
| 712 Building frame and related trades w orkers | 3 240 | 3 343 | 103 | 1.41 | 1.40 |
| 713 Building finishers and related trades w orkers | 6 022 | 5 981 | - 41 | 2.61 | 2.51 |
| 714 Painters; building structure cleaners and related trades w orkers | 3 240 | 3 909 | 669 | 1.41 | 1.64 |

| | | | | | |
|---|---|---|---|---|---|
| **72 Metal, machinery and related trades workers** | **10 825** | **9 250** | **-1 575** | **4.70** | **3.88** |
| 720 Other: metal, machinery and related trades w orkers | 0 | 0 | 0 | 0.00 | 0.00 |
| 721 Metal moulders; w elders; sheet-metal w orkers; structural- metal preparers | 2 747 | 2 339 | - 408 | 1.19 | 0.98 |
| 722 Blacksmiths; tool-makers and related trades w orkers | 1 960 | 1 643 | - 317 | 0.85 | 0.69 |
| 723 Machinery mechanics and fitters | 4 271 | 3 710 | - 561 | 1.85 | 1.55 |
| 724 Electrical and electronic equipment mechanics and fitters | 1 848 | 1 558 | - 290 | 0.80 | 0.65 |
| **73 Precision, handicraft, craft printing and related trades workers** | **1 192** | **1 002** | **- 190** | **0.52** | **0.42** |
| 730 Other: recision, handicraft, craft printing and related trades w orkers | 0 | 0 | 0 | 0.00 | 0.00 |
| 731 Precision w orkers in metal and related materials | 538 | 481 | - 56 | 0.23 | 0.20 |
| 732 Potters; glass-makers and related trades w orkers | 215 | 177 | - 37 | 0.09 | 0.07 |
| 733 Handicraft w orkers in w ood;textile; leather and related materials | 53 | 61 | 7 | 0.02 | 0.03 |
| 734 Printing and related trades w orkers | 387 | 283 | - 104 | 0.17 | 0.12 |
| **74 Other craft and related trades workers** | **4 201** | **3 571** | **- 630** | **1.82** | **1.50** |
| 740 Other: other craft and related trades w orkers | 0 | 0 | 0 | 0.00 | 0.00 |
| 741 Food processing and related trades w orkers | 1 572 | 1 224 | - 348 | 0.68 | 0.51 |
| 742 Wood treaters; cabinet-makers and related trades w orkers | 1 426 | 1 372 | - 54 | 0.62 | 0.57 |
| 743 Textile; garment and related trades w orkers | 1 039 | 852 | - 187 | 0.45 | 0.36 |
| 744 Pelt; leather and shoemaking trades w orkers | 165 | 123 | - 41 | 0.07 | 0.05 |
| **81 Stationary plant and related operators** | **2 036** | **2 174** | **137** | **0.88** | **0.91** |
| 810 Other: stationary plant and related operators | 0 | 0 | 0 | 0.00 | 0.00 |
| 811 Mining- and mineral-processing-plant operators | 82 | 94 | 11 | 0.04 | 0.04 |
| 812 Metal-processing-plant operators | 574 | 731 | 157 | 0.25 | 0.31 |
| 813 Glass; ceramics and related plant operators | 49 | 47 | - 2 | 0.02 | 0.02 |
| 814 Wood-processing- and papermaking-plant operators | 213 | 194 | - 19 | 0.09 | 0.08 |
| 815 Chemical-processing-plant operators | 628 | 609 | - 18 | 0.27 | 0.26 |
| 816 Pow er-production and related plant operators | 490 | 499 | 9 | 0.21 | 0.21 |
| 817 Automated-assembly-line and industrial-robot operators | 0 | 0 | 0 | 0.00 | 0.00 |
| **82 Machine operators and assemblers** | **6 386** | **6 456** | **70** | **2.77** | **2.70** |
| 820 Other: machine operators and assemblers | 0 | 0 | 0 | 0.00 | 0.00 |
| 821 Metal- and mineral-products machine operators | 878 | 855 | - 23 | 0.38 | 0.36 |
| 822 Chemical-products machine operators | 492 | 511 | 19 | 0.21 | 0.21 |
| 823 Rubber- and plastic-products machine operators | 575 | 566 | - 9 | 0.25 | 0.24 |
| 824 Wood-products machine operators | 32 | 36 | 3 | 0.01 | 0.01 |
| 825 Printing-; binding- and paper-products machine operators | 173 | 192 | 18 | 0.08 | 0.08 |
| 826 Textile-; fur- and leather-products machine operators | 720 | 747 | 27 | 0.31 | 0.31 |
| 827 Food and related products machine operators | 539 | 592 | 53 | 0.23 | 0.25 |
| 828 Assemblers | 1 087 | 1 078 | - 8 | 0.47 | 0.45 |
| 829 Other machine operators and assemblers | 1 890 | 1 878 | - 12 | 0.82 | 0.79 |

| | | | | | |
|---|---|---|---|---|---|
| **83 Drivers and mobile plant operators** | **9 425** | **9 196** | **- 229** | **4.09** | **3.85** |
| 830 Other: drivers and mobile plant operators | 0 | 0 | 0 | 0.00 | 0.00 |
| 831 Locomotive-engine drivers and related w orkers | 872 | 869 | - 3 | 0.38 | 0.36 |
| 832 Motor-vehicle drivers | 6 918 | 6 883 | - 36 | 3.00 | 2.88 |
| 833 Agricultural and other mobile-plant operators | 1 585 | 1 399 | - 186 | 0.69 | 0.59 |
| 834 Ships' deck crew s and related w orkers | 50 | 45 | - 5 | 0.02 | 0.02 |
| **91 Sales and services elementary occupations** | **15 168** | **16 188** | **1 020** | **6.59** | **6.78** |
| 910 Other: sales and services elementary occupations | 0 | 0 | 0 | 0.00 | 0.00 |
| 911 Street vendors and related w orkers | 90 | 113 | 23 | 0.04 | 0.05 |
| 912 Shoe cleaning and other street services elementary occupations | 0 | 0 | 0 | 0.00 | 0.00 |
| 913 Domestic and related helpers; cleaners and launderers | 9 294 | 9 721 | 426 | 4.04 | 4.07 |
| 914 Building caretakers; w indow and related cleaners | 2 915 | 3 046 | 132 | 1.27 | 1.28 |
| 915 Messengers; porters; doorkeepers and related w orkers | 2 540 | 2 945 | 405 | 1.10 | 1.23 |
| 916 Garbage Collectors and Related Labourers | 329 | 362 | 34 | 0.14 | 0.15 |
| **92 Agricultural, fishery and related labourers** | **1 839** | **2 106** | **267** | **0.80** | **0.88** |
| 920 Other: agricultural, fishery and related labourers | 0 | 0 | 0 | 0.00 | 0.00 |
| 921 Agricultural; fishery and related labourers | 1 839 | 2 106 | 267 | 0.80 | 0.88 |
| **93 Labourers in mining, construction, manufacturing and transport** | **6 351** | **7 564** | **1 213** | **2.76** | **3.17** |
| 930 Other: labourers in mining, construction, manufacturing and transport | 0 | 0 | 0 | 0.00 | 0.00 |
| 931 Mining and construction labourers | 511 | 497 | - 15 | 0.22 | 0.21 |
| 932 Manufacturing labourers | 3 825 | 4 542 | 717 | 1.66 | 1.90 |
| 933 Transport labourers and freight handlers | 2 015 | 2 525 | 511 | 0.87 | 1.06 |
| **All occupations** | **230 308** | **238 684** | **8 377** | **100.00** | **100.00** |

NB: Visit http://www.cedefop.europa.eu/EN/about-cedefop/projects/forecasting-skill-demand-and-supply/skills-forecasts.aspx for possible updates of this table.
All occupations including ISCO 0 Armed forces.
*Source*: Cedefop (IER estimates).

Table 12 **Total job openings (expansion and replacement demand) by sector, 2010-20, EU-27+**

| | All qualifications | | | Low qualification | | | Medium qualification | | | High qualification | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Expansion demand | Replacement Demand | Total Requirement | Expansion demand | Replacement Demand | Total Requirement | Expansion demand | Replacement Demand | Total Requirement | Expansion demand | Replacement Demand | Total Requirement |
| Primary sector and utilities | -1 487 | 6 985 | 5 499 | -2 367 | 3 682 | 1 315 | - 64 | 2 596 | 2 532 | 945 | 708 | 1 653 |
| Agriculture, etc. | -1 239 | 6 266 | 5 028 | -2 280 | 3 574 | 1 294 | 233 | 2 221 | 2 454 | 809 | 471 | 1 280 |
| Mining and quarrying | - 154 | 222 | 68 | - 44 | 50 | 6 | - 120 | 118 | - 2 | 10 | 54 | 65 |
| Electricity, gas and water | - 94 | 497 | 403 | - 43 | 58 | 15 | - 177 | 257 | 80 | 126 | 182 | 308 |
| Manufacturing | - 457 | 9 975 | 9 518 | -2 336 | 2 619 | 283 | - 635 | 4 957 | 4 322 | 2 514 | 2 399 | 4 913 |
| Food, drink and tobacco | 5 | 1 342 | 1 347 | - 407 | 426 | 19 | 90 | 687 | 777 | 322 | 229 | 551 |
| Engineering | 238 | 2 125 | 2 364 | - 346 | 387 | 42 | - 99 | 1 066 | 967 | 683 | 672 | 1 355 |
| Rest of manufacturing | - 700 | 6 508 | 5 808 | -1 583 | 1 806 | 223 | - 626 | 3 204 | 2 578 | 1 509 | 1 498 | 3 007 |
| Construction | 216 | 4 548 | 4 764 | -1 487 | 1 553 | 66 | 773 | 2 314 | 3 087 | 930 | 681 | 1 611 |
| Distribution and transport | 3 485 | 18 757 | 22 243 | -3 676 | 5 411 | 1 735 | 1 360 | 9 805 | 11 166 | 5 801 | 3 541 | 9 342 |
| Distribution | 1 991 | 10 774 | 12 765 | -1 911 | 2 944 | 1 032 | 474 | 5 676 | 6 150 | 3 428 | 2 155 | 5 583 |
| Hotels and catering | 994 | 3 651 | 4 646 | - 828 | 1 361 | 533 | 838 | 1 806 | 2 644 | 984 | 485 | 1 469 |
| Transport and telecommunications | 500 | 4 332 | 4 832 | - 937 | 1 107 | 170 | 48 | 2 323 | 2 372 | 1 389 | 902 | 2 290 |
| Business and other services | 5 731 | 17 115 | 22 846 | -1 678 | 3 663 | 1 985 | 1 689 | 6 842 | 8 531 | 5 720 | 6 610 | 12 330 |
| Banking and insurance | 312 | 1 925 | 2 236 | - 158 | 144 | - 14 | - 386 | 833 | 447 | 856 | 948 | 1 804 |
| Other business services | 4 185 | 9 897 | 14 082 | - 211 | 1 914 | 1 702 | 1 078 | 3 744 | 4 822 | 3 319 | 4 239 | 7 558 |
| Miscellaneous services | 1 234 | 5 294 | 6 527 | -1 309 | 1 605 | 297 | 997 | 2 265 | 3 263 | 1 545 | 1 423 | 2 968 |
| Non-marketed services | 1 110 | 17 788 | 18 898 | -2 130 | 2 277 | 147 | - 486 | 6 055 | 5 569 | 3 726 | 9 456 | 13 182 |
| Public admin and defence | - 400 | 4 569 | 4 169 | - 743 | 699 | - 44 | - 950 | 1 899 | 949 | 1 293 | 1 971 | 3 264 |
| Education | 253 | 5 832 | 6 084 | - 499 | 455 | - 44 | 368 | 1 296 | 1 663 | 384 | 4 081 | 4 465 |
| Health and social work | 1 257 | 7 388 | 8 645 | - 888 | 1 123 | 235 | 96 | 2 861 | 2 957 | 2 048 | 3 404 | 5 452 |
| All industries | 8 598 | 75 169 | 83 768 | -13 674 | 19 205 | 5 531 | 2 637 | 32 569 | 35 206 | 19 636 | 23 395 | 43 031 |

NB: Visit http://www.cedefop.europa.eu/EN/about-cedefop/projects/forecasting-skill-demand-and-supply/skills-forecasts.aspx for possible updates of this table.
*Source*: Cedefop (IER estimates).

Table 13 **Total job openings (expansion and replacement demand) by occupation, 2010-20, EU-27+**

| | Change 2010-20 (000s) | | | Change 2010-20 (% of 2010 level) | | |
|---|---|---|---|---|---|---|
| | Expansion demand | Replacement demand | Total requirement | Expansion demand | Replacement demand | Total requirement |
| **Legislators, senior officials and managers** | **1 556** | **8 659** | **10 215** | **8.00** | **44.5** | **52.5** |
| 11 Legislators and senior officials | 27 | 275 | 302 | 6.5 | 67.5 | 74.0 |
| 12 Corporate managers | 1 016 | 4 184 | 5 200 | 9.2 | 38.0 | 47.2 |
| 13 Managers of small enterprises | 513 | 4 200 | 4 713 | 6.4 | 52.4 | 58.8 |
| **Professionals** | **2 819** | **12 138** | **14 957** | **8.2** | **35.4** | **43.7** |
| 21 Physical, mathematical and engineering science professionals | 1 237 | 2 517 | 3 754 | 14.2 | 29.0 | 43.2 |
| 22 Life science and health professionals | -45 | 1 734 | 1 688 | -1.1 | 40.9 | 39.8 |
| 23 Teaching professionals | -659 | 3 633 | 2 973 | -7.2 | 39.8 | 32.6 |
| 24 Other professionals | 2 286 | 4 255 | 6 541 | 18.8 | 34.9 | 53.7 |
| **Technicians and associate professionals** | **5 012** | **11 258** | **16 269** | **13.0** | **29.1** | **42.1** |
| 31 Physical and engineering science associate professionals | 555 | 2 393 | 2 948 | 6.4 | 27.5 | 33.9 |
| 32 Life science and health associate professionals | 727 | 1 816 | 2 543 | 11.3 | 28.3 | 39.7 |
| 33 Teaching associate professionals | 697 | 939 | 1 636 | 23.6 | 31.8 | 55.5 |
| 34 Other associate professionals | 3 032 | 6 110 | 9 142 | 14.7 | 29.7 | 44.4 |
| **Clerks** | **-1 786** | **7 369** | **5 583** | **-7.3** | **30.2** | **22.9** |
| 41 Office clerks | -2 847 | 6 107 | 3 260 | -14.5 | 31.1 | 16.6 |
| 42 Customer services clerks | 1 061 | 1 262 | 2 323 | 22.5 | 26.8 | 49.3 |
| **Service workers and shop and market sales workers** | **1 170** | **8 676** | **9 845** | **3.6** | **26.8** | **30.4** |
| 51 Personal and protective services workers | 554 | 5 908 | 6 461 | 2.6 | 28.2 | 30.8 |
| 52 Models, salespersons and demonstrators | 616 | 2 768 | 3 384 | 5.4 | 24.3 | 29.7 |
| **Skilled agricultural and fishery workers** | **-905** | **5 445** | **4 540** | **-9.4** | **56.4** | **47.0** |
| 61 Skilled agricultural and fishery workers | -905 | 5 445 | 4 540 | -9.4 | 56.4 | 47.0 |
| **Craft and related trades workers** | **-1 744** | **7 646** | **5 901** | **-6.0** | **26.2** | **20.2** |
| 71 Extraction and building trades workers | 650 | 3 367 | 4 017 | 5.0 | 26.0 | 31.0 |
| 72 Metal, machinery and related trades workers | -1 575 | 2 830 | 1 255 | -14.5 | 26.1 | 11.6 |
| 73 Precision, handicraft, craft printing and related trades workers | -190 | 389 | 199 | -15.9 | 32.6 | 16.7 |
| 74 Other craft and related trades workers | -630 | 1 059 | 429 | -15.0 | 25.2 | 10.2 |

| | Change 2010-20 (000s) | | | Change 2010-20 (% of 2010 level) | | |
|---|---|---|---|---|---|---|
| | Expansion demand | Replacement demand | Total requirement | Expansion demand | Replacement demand | Total requirement |
| **Plant and machine operators and assemblers** | **-22** | **5 263** | **5 241** | **-0.1** | **29.5** | **29.4** |
| 81 Stationary plant and related operators | 137 | 490 | 627 | 6.7 | 24.0 | 30.8 |
| 82 Machine operators and assemblers | 70 | 1 534 | 1 605 | 1.1 | 24.0 | 25.1 |
| 83 Drivers and mobile plant operators | -229 | 3 239 | 3 010 | -2.4 | 34.4 | 31.9 |
| **Elementary occupations** | **2 500** | **8 716** | **11 216** | **10.7** | **37.3** | **48.0** |
| 91 Sales and services elementary occupations | 1 020 | 6 392 | 7 412 | 6.7 | 42.1 | 48.9 |
| 92 Agricultural, fishery and related labourers | 267 | 792 | 1 060 | 14.5 | 43.1 | 57.6 |
| 93 Labourers in mining, construction, manufacturing and transport | 1 213 | 1 532 | 2 744 | 19.1 | 24.1 | 43.2 |
| **All occupations** | **8 376.57** | **75 309.11** | **83 685.68** | **3.6** | **32.7** | **36.3** |

NB: Visit http://www.cedefop.europa.eu/EN/about-cedefop/projects/forecasting-skill-demand-and-supply/skills-forecasts.aspx for possible updates of this table.
All occupations including ISCO 0 Armed forces.
*Source*: Cedefop (IER estimates).

Table 14 **Employment trends by country, 2000-20**

| All industries | Levels (000s) | | | Share of EU-27+ total (%) | | | Change 2010-20 | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2000 | 2010 | 2020 | 2000 | 2010 | 2020 | 000s | % | % p.a. |
| BE | 4 109 | 4 467 | 4 827 | 1.9 | 1.9 | 2.0 | 360 | 8.1 | 0.8 |
| BG | 3 239 | 3 558 | 3 553 | 1.5 | 1.5 | 1.5 | -5 | -0.1 | 0.0 |
| CZ | 4 940 | 5 156 | 5 319 | 2.3 | 2.2 | 2.2 | 162 | 3.1 | 0.3 |
| DK | 2 755 | 2 804 | 2 920 | 1.3 | 1.2 | 1.2 | 116 | 4.2 | 0.4 |
| DE | 39 144 | 40 490 | 40 247 | 17.9 | 17.6 | 16.9 | -243 | -0.6 | -0.1 |
| EE | 586 | 575 | 617 | 0.3 | 0.2 | 0.3 | 42 | 7.2 | 0.7 |
| IE | 1 696 | 1 844 | 1 947 | 0.8 | 0.8 | 0.8 | 103 | 5.6 | 0.6 |
| EL | 4 255 | 4 658 | 4 841 | 1.9 | 2.0 | 2.0 | 184 | 3.9 | 0.4 |
| ES | 16 412 | 18 700 | 19 629 | 7.5 | 8.1 | 8.2 | 929 | 5.0 | 0.5 |
| FR | 24 332 | 25 417 | 27 567 | 11.1 | 11.0 | 11.5 | 2 149 | 8.5 | 0.8 |
| IT | 22 930 | 24 658 | 25 454 | 10.5 | 10.7 | 10.7 | 796 | 3.2 | 0.3 |
| CY | 315 | 392 | 445 | 0.1 | 0.2 | 0.2 | 53 | 13.5 | 1.4 |
| LV | 940 | 930 | 1 011 | 0.4 | 0.4 | 0.4 | 81 | 8.7 | 0.9 |
| LI | 1 399 | 1 342 | 1 429 | 0.6 | 0.6 | 0.6 | 87 | 6.5 | 0.6 |
| LU | 262 | 357 | 391 | 0.1 | 0.2 | 0.2 | 33 | 9.3 | 0.9 |
| HU | 4 250 | 4 006 | 4 174 | 1.9 | 1.7 | 1.7 | 168 | 4.2 | 0.4 |
| MT | 146 | 166 | 169 | 0.1 | 0.1 | 0.1 | 3 | 1.7 | 0.2 |
| NL | 8 115 | 8 589 | 9 022 | 3.7 | 3.7 | 3.8 | 432 | 5.0 | 0.5 |
| AT | 3 788 | 4 120 | 4 279 | 1.7 | 1.8 | 1.8 | 159 | 3.9 | 0.4 |
| PL | 13 624 | 15 861 | 15 808 | 6.2 | 6.9 | 6.6 | -53 | -0.3 | 0.0 |
| PT | 4 981 | 4 940 | 5 031 | 2.3 | 2.1 | 2.1 | 91 | 1.8 | 0.2 |
| RO | 10 771 | 9 007 | 9 136 | 4.9 | 3.9 | 3.8 | 129 | 1.4 | 0.1 |
| SI | 905 | 950 | 972 | 0.4 | 0.4 | 0.4 | 22 | 2.3 | 0.2 |
| SK | 2 025 | 2 155 | 2 324 | 0.9 | 0.9 | 1.0 | 169 | 7.8 | 0.8 |
| FI | 2 293 | 2 443 | 2 523 | 1.0 | 1.1 | 1.1 | 80 | 3.3 | 0.3 |
| SE | 4 294 | 4 496 | 4 786 | 2.0 | 2.0 | 2.0 | 290 | 6.4 | 0.6 |
| UK | 29 614 | 31 137 | 32 427 | 13.6 | 13.5 | 13.6 | 1 290 | 4.1 | 0.4 |
| EU-27 | 212 121 | 223 219 | 230 847 | 97.1 | 96.9 | 96.7 | 7 627 | 3.4 | 0.3 |
| NO | 2 321 | 2 537 | 2 807 | 1.1 | 1.1 | 1.2 | 270 | 10.7 | 1.1 |
| CH | 4 088 | 4 551 | 5 031 | 1.9 | 2.0 | 2.1 | 479 | 10.5 | 1.1 |
| EU-27+ | 218 530 | 230 308 | 238 684 | 100.0 | 100.0 | 100.0 | 8 377 | 3.6 | 0.4 |

NB: Visit http://www.cedefop.europa.eu/EN/about-cedefop/projects/forecasting-skill-demand-and-supply/skills-forecasts.aspx for possible updates of this table.
*Source*: Cedefop (IER estimates).

Table 15 **Employment trends by country and broad sector, 2010-20 (in 000s)**

| | Primary sector and utilities | | Manufacturing | | Construction | | Distribution and transport | | Business and other services | | Non-marketed services | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Levels 2010 | Change 2010-20 | Levels 2010 | Change 2010-20 | Levels 2010 | Change 2010-20 | Levels 2010 | Change 2010-20 | Levels 2010 | Change 2010-20 | Levels 2010 | Change 2010-20 |
| AT | 249 | - 12 | 628 | - 13 | 271 | 31 | 1 136 | 26 | 881 | 75 | 955 | 51 |
| BE | 108 | - 14 | 546 | - 60 | 263 | 13 | 1 047 | 65 | 1 182 | 205 | 1 321 | 151 |
| BG | 794 | - 67 | 636 | - 68 | 198 | 2 | 968 | 34 | 398 | 68 | 564 | 25 |
| CY | 20 | - 3 | 38 | 1 | 37 | 8 | 133 | 29 | 87 | 12 | 77 | 5 |
| CZ | 287 | - 19 | 1 256 | - 31 | 456 | 5 | 1 318 | 35 | 944 | 112 | 895 | 61 |
| DK | 95 | - 19 | 336 | - 12 | 165 | 27 | 729 | 14 | 594 | 74 | 885 | 32 |
| EE | 39 | - 4 | 115 | 9 | 37 | 9 | 147 | 13 | 95 | 14 | 142 | 2 |
| FI | 137 | - 4 | 375 | 6 | 176 | 6 | 572 | 59 | 475 | 16 | 707 | - 3 |
| FR | 971 | - 25 | 3 086 | 25 | 1 764 | 157 | 5 841 | 525 | 6 171 | 1 215 | 7 585 | 253 |
| DE | 1 201 | - 68 | 7 312 | - 210 | 2 232 | 22 | 10 078 | - 178 | 10 095 | 248 | 9 572 | - 56 |
| EL | 596 | - 71 | 477 | 19 | 325 | - 40 | 1 499 | 140 | 784 | 81 | 975 | 55 |
| HU | 349 | 8 | 842 | 70 | 290 | 3 | 989 | 7 | 611 | 79 | 926 | 0 |
| IE | 107 | 8 | 219 | - 2 | 131 | 31 | 511 | 26 | 396 | 42 | 480 | - 1 |
| IT | 1 163 | - 323 | 4 611 | 15 | 1 897 | - 136 | 6 020 | 290 | 6 408 | 1 027 | 4 560 | - 77 |
| LV | 98 | - 8 | 140 | 24 | 63 | 11 | 294 | 30 | 156 | 33 | 181 | - 9 |
| LI | 146 | - 17 | 214 | - 2 | 96 | 1 | 379 | 29 | 194 | 59 | 314 | 17 |
| LU | 7 | - 1 | 34 | 1 | 39 | 0 | 92 | 5 | 122 | 24 | 63 | 5 |
| MT | 6 | - 1 | 36 | - 3 | 13 | 0 | 49 | 2 | 18 | 1 | 44 | 3 |
| NL | 294 | - 11 | 881 | - 22 | 478 | 31 | 2 200 | 171 | 2 458 | 148 | 2 279 | 117 |
| PL | 2 529 | - 376 | 3 019 | - 244 | 1 235 | 128 | 3 762 | 242 | 2 048 | 96 | 3 268 | 101 |
| PT | 566 | - 41 | 806 | - 21 | 470 | 5 | 1 277 | 165 | 797 | 71 | 1 024 | - 89 |
| RO | 2 548 | - 255 | 1 876 | 41 | 766 | 9 | 1 888 | 196 | 692 | 80 | 1 237 | 58 |
| SK | 102 | - 12 | 473 | 5 | 186 | 40 | 628 | 29 | 322 | 65 | 444 | 43 |
| SI | 98 | - 14 | 201 | 12 | 80 | 1 | 213 | 9 | 185 | 5 | 172 | 9 |
| ES | 997 | - 20 | 2 443 | 71 | 1 651 | - 175 | 5 480 | 841 | 4 162 | 413 | 3 967 | - 201 |
| SE | 141 | - 12 | 648 | 17 | 307 | 48 | 969 | 48 | 1 008 | 74 | 1 423 | 115 |
| UK | 713 | - 75 | 2 745 | - 103 | 2 051 | - 61 | 8 651 | 393 | 8 696 | 1 140 | 8 280 | - 4 |
| EU-27 | 14 363 | -1 456 | 33 990 | - 476 | 15 678 | 177 | 56 870 | 3 245 | 49 978 | 5 476 | 52 340 | 662 |
| NO | 117 | - 15 | 264 | - 20 | 173 | 13 | 635 | 49 | 463 | 115 | 885 | 127 |
| CH | 173 | - 15 | 693 | 39 | 300 | 26 | 1 205 | 193 | 1 119 | 129 | 1 060 | 108 |
| EU-27+ | 14 653 | -1 487 | 34 948 | - 456 | 16 152 | 216 | 58 710 | 3 487 | 51 560 | 5 720 | 54 285 | 897 |

NB: Visit http://www.cedefop.europa.eu/EN/about-cedefop/projects/forecasting-skill-demand-and-supply/skills-forecasts.aspx for possible updates of this table.
*Source*: Cedefop (IER estimates).

Table 16 **Employment by country and occupation, 2010 (in thousands)**

*Levels (thousands)*

| Occupation major group 2010 | Legislators, senior officials and managers | Professionals | Technicians and associate professionals | Clerks | Service workers and shop and market sales workers | Skilled agricultural and fishery workers | Craft and related trades workers | Plant and machine operators and assemblers | Elementary occupations | All |
|---|---|---|---|---|---|---|---|---|---|---|
| BE | 518 | 1 006 | 525 | 659 | 501 | 94 | 390 | 304 | 439 | 4 467 |
| BG | 229 | 433 | 326 | 250 | 505 | 392 | 425 | 469 | 503 | 3 558 |
| CZ | 346 | 679 | 1 221 | 349 | 602 | 75 | 868 | 724 | 277 | 5 156 |
| DK | 182 | 469 | 659 | 260 | 456 | 66 | 250 | 160 | 292 | 2 804 |
| DE | 2 354 | 6 235 | 8 703 | 5 044 | 5 433 | 733 | 5 501 | 2 683 | 3 670 | 40 490 |
| EE | 69 | 102 | 78 | 32 | 77 | 10 | 75 | 77 | 53 | 575 |
| IE | 284 | 334 | 138 | 246 | 337 | 13 | 194 | 138 | 154 | 1 844 |
| EL | 478 | 688 | 412 | 514 | 696 | 526 | 592 | 319 | 366 | 4 658 |
| ES | 1 409 | 2 495 | 2 319 | 1 728 | 3 179 | 498 | 2 477 | 1 685 | 2 804 | 18 700 |
| FR | 2 285 | 3 810 | 4 863 | 2 990 | 3 319 | 927 | 2 583 | 1 726 | 2 673 | 25 417 |
| IT | 1 983 | 2 540 | 5 168 | 2 800 | 2 769 | 575 | 3 905 | 1 932 | 2 743 | 24 658 |
| CY | 21 | 52 | 47 | 54 | 68 | 12 | 48 | 21 | 65 | 392 |
| LV | 85 | 158 | 153 | 45 | 125 | 30 | 121 | 87 | 125 | 930 |
| LI | 138 | 261 | 166 | 56 | 180 | 83 | 204 | 130 | 120 | 1 342 |
| LU | 21 | 90 | 61 | 51 | 32 | 6 | 40 | 23 | 32 | 357 |
| HU | 311 | 648 | 527 | 348 | 556 | 155 | 614 | 478 | 339 | 4 006 |
| MT | 14 | 27 | 25 | 16 | 25 | 3 | 22 | 15 | 18 | 166 |
| NL | 960 | 1 727 | 1 529 | 1 051 | 1 248 | 119 | 746 | 445 | 731 | 8 589 |
| AT | 269 | 471 | 837 | 527 | 615 | 204 | 488 | 220 | 476 | 4 120 |
| PL | 1 103 | 2 809 | 1 838 | 1 173 | 1 562 | 1 874 | 2 639 | 1 535 | 1 259 | 15 861 |
| PT | 322 | 582 | 501 | 499 | 723 | 436 | 864 | 380 | 605 | 4 940 |
| RO | 206 | 1 200 | 817 | 425 | 959 | 1 905 | 1 416 | 980 | 1 056 | 9 007 |
| SI | 86 | 176 | 155 | 78 | 95 | 50 | 107 | 111 | 87 | 950 |
| SK | 142 | 287 | 432 | 131 | 311 | 17 | 340 | 304 | 178 | 2 155 |
| FI | 251 | 466 | 402 | 155 | 391 | 108 | 284 | 191 | 183 | 2 443 |
| SE | 239 | 891 | 923 | 371 | 831 | 90 | 452 | 427 | 263 | 4 496 |
| UK | 4 935 | 4 378 | 4 175 | 3 825 | 5 428 | 422 | 2 571 | 1 869 | 3 463 | 31 137 |
| EU-27 | 19 239 | 33 010 | 37 000 | 23 679 | 31 020 | 9 426 | 28 217 | 17 435 | 22 974 | 223 219 |
| NO | 135 | 351 | 634 | 177 | 616 | 58 | 260 | 176 | 121 | 2 537 |
| CH | 70 | 881 | 1 012 | 505 | 708 | 168 | 705 | 236 | 264 | 4 551 |
| EU-27+ | 19 444 | 34 242 | 38 646 | 24 361 | 32 344 | 9 652 | 29 182 | 17 847 | 23 358 | 230 308 |

NB: Visit http://www.cedefop.europa.eu/EN/about-cedefop/projects/forecasting-skill-demand-and-supply/skills-forecasts.aspx for possible updates of this table.
*Source*: Cedefop (IER estimates).

Table 17 **Employment change (expansion demand) by country and occupation, 2010-20 (in thousands)**

*Levels (thousands)*

| Occupation major group 2010-20 | Legislators, senior officials and managers | Professionals | Technicians and associate professionals | Clerks | Service workers and shop and market sales workers | Skilled agricultural and fishery workers | Craft and related trades workers | Plant and machine operators and assemblers | Elementary occupations | All |
|---|---|---|---|---|---|---|---|---|---|---|
| BE | 61 | 103 | 105 | - 39 | 72 | 8 | - 91 | 111 | 44 | 360 |
| BG | - 37 | 19 | 46 | 30 | 9 | - 67 | - 60 | - 16 | 79 | - 5 |
| CZ | 18 | 48 | 257 | - 19 | - 23 | - 8 | - 73 | - 13 | - 23 | 162 |
| DK | 7 | 83 | 120 | - 58 | - 9 | - 11 | 1 | - 7 | - 8 | 116 |
| DE | - 111 | 363 | 125 | - 369 | 87 | - 12 | - 314 | - 106 | 137 | - 243 |
| EE | 11 | 7 | 4 | 6 | 4 | - 3 | - 1 | 13 | 0 | 42 |
| IE | 45 | - 17 | 38 | - 39 | 2 | 0 | 42 | - 1 | 35 | 103 |
| EL | - 19 | 41 | 126 | 6 | 95 | - 87 | - 62 | 20 | 64 | 184 |
| ES | 41 | - 12 | 652 | 40 | 391 | - 132 | - 262 | 70 | 150 | 929 |
| FR | 400 | 676 | 664 | - 487 | 234 | 76 | - 124 | - 110 | 883 | 2 149 |
| IT | 704 | 165 | 781 | 14 | - 563 | - 138 | - 168 | - 115 | 68 | 796 |
| CY | 17 | 8 | 7 | 11 | 2 | - 3 | 0 | - 1 | 12 | 53 |
| LV | 13 | 36 | 17 | 3 | 2 | - 9 | 11 | 4 | 3 | 81 |
| LI | - 5 | 65 | 35 | - 11 | 8 | - 8 | 8 | - 4 | - 4 | 87 |
| LU | 2 | 30 | 1 | 11 | - 1 | - 1 | - 7 | - 3 | 1 | 33 |
| HU | 48 | 95 | 0 | 0 | - 1 | 4 | - 101 | 78 | 61 | 168 |
| MT | - 2 | 4 | 3 | - 2 | 6 | 0 | 1 | - 4 | - 2 | 3 |
| NL | - 18 | 240 | 24 | 50 | 155 | - 22 | - 38 | - 43 | 88 | 432 |
| AT | 6 | 34 | 64 | - 43 | 78 | 10 | - 55 | - 31 | 95 | 159 |
| PL | 69 | 306 | 134 | - 13 | - 190 | - 249 | 65 | - 70 | - 77 | - 53 |
| PT | - 13 | 84 | 17 | - 15 | 28 | - 19 | - 66 | 17 | 71 | 91 |
| RO | - 85 | 348 | - 67 | 8 | 245 | - 300 | - 291 | 146 | 160 | 129 |
| SI | 17 | 38 | 16 | - 20 | - 10 | - 29 | - 1 | - 21 | 29 | 22 |
| SK | 23 | 33 | 63 | - 15 | 18 | - 2 | 21 | - 3 | 14 | 169 |
| FI | - 4 | 50 | 26 | - 38 | - 9 | - 7 | 19 | 16 | 34 | 80 |
| SE | 43 | 99 | 65 | - 53 | 94 | - 15 | 18 | 21 | 21 | 290 |
| UK | 345 | - 482 | 1 464 | - 630 | 266 | 120 | - 279 | 0 | 527 | 1 290 |
| EU-27 | 1 575 | 2 466 | 4 787 | -1 672 | 990 | - 902 | -1 807 | - 53 | 2 462 | 7 627 |
| NO | - 30 | 126 | 142 | - 31 | 88 | - 18 | 10 | - 7 | - 8 | 270 |
| CH | 11 | 227 | 82 | - 84 | 92 | 15 | 52 | 38 | 45 | 479 |
| EU-27+ | 1 556 | 2 819 | 5 012 | -1 786 | 1 170 | - 905 | -1 744 | - 22 | 2 500 | 8 377 |

NB: Visit http://www.cedefop.europa.eu/EN/about-cedefop/projects/forecasting-skill-demand-and-supply/skills-forecasts.aspx for possible updates of this table.
*Source*: Cedefop (IER estimates).

Table 18 **Replacement demand by country and occupation, 2010-20 (in thousands)**

*Replacement demand (thousands)*

| Occupation major group 2010-20 | Legislators, senior officials and managers | Professionals | Technicians and associate professionals | Clerks | Service workers and shop and market sales workers | Skilled agricultural and fishery workers | Craft and related trades workers | Plant and machine operators and assemblers | Elementary occupations | All |
|---|---|---|---|---|---|---|---|---|---|---|
| BE | 188 | 272 | 143 | 188 | 132 | 39 | 75 | 61 | 128 | 1 228 |
| BG | 76 | 129 | 85 | 60 | 128 | 209 | 103 | 112 | 180 | 1 087 |
| CZ | 119 | 228 | 339 | 97 | 164 | 26 | 225 | 187 | 147 | 1 532 |
| DK | 96 | 195 | 242 | 106 | 124 | 41 | 89 | 76 | 108 | 1 079 |
| DE | 1 150 | 2 588 | 2 791 | 1 649 | 1 566 | 283 | 1 499 | 935 | 1 606 | 14 078 |
| EE | 19 | 34 | 19 | 8 | 22 | 4 | 17 | 19 | 36 | 179 |
| IE | 106 | 71 | 25 | 50 | 59 | 4 | 35 | 42 | 45 | 438 |
| EL | 205 | 200 | 64 | 97 | 136 | 372 | 140 | 84 | 96 | 1 396 |
| ES | 787 | 906 | 703 | 486 | 913 | 300 | 780 | 546 | 920 | 6 356 |
| FR | 960 | 1 371 | 1 297 | 978 | 856 | 399 | 592 | 399 | 1 009 | 7 884 |
| IT | 1 187 | 1 156 | 1 441 | 621 | 539 | 347 | 1 105 | 473 | 873 | 7 788 |
| CY | 8 | 10 | 8 | 7 | 12 | 13 | 13 | 6 | 17 | 94 |
| LV | 21 | 46 | 35 | 12 | 31 | 12 | 31 | 24 | 54 | 267 |
| LI | 34 | 85 | 38 | 13 | 39 | 40 | 42 | 28 | 50 | 368 |
| LU | 7 | 30 | 17 | 16 | 9 | 3 | 10 | 4 | 10 | 106 |
| HU | 96 | 165 | 121 | 80 | 118 | 42 | 113 | 83 | 99 | 919 |
| MT | 6 | 9 | 9 | 5 | 7 | 1 | 7 | 5 | 6 | 56 |
| NL | 395 | 580 | 380 | 279 | 292 | 36 | 191 | 157 | 203 | 2 514 |
| AT | 94 | 150 | 187 | 111 | 116 | 122 | 74 | 53 | 138 | 1 046 |
| PL | 267 | 497 | 302 | 150 | 227 | 577 | 352 | 223 | 290 | 2 892 |
| PT | 196 | 192 | 131 | 114 | 229 | 379 | 225 | 122 | 250 | 1 842 |
| RO | 47 | 237 | 125 | 52 | 124 | 1 617 | 220 | 143 | 363 | 2 931 |
| SI | 34 | 49 | 35 | 17 | 16 | 50 | 26 | 24 | 36 | 287 |
| SK | 45 | 88 | 91 | 29 | 59 | 5 | 72 | 68 | 60 | 517 |
| FI | 105 | 134 | 125 | 50 | 96 | 67 | 71 | 52 | 64 | 765 |
| SE | 115 | 369 | 358 | 148 | 243 | 66 | 146 | 155 | 94 | 1 694 |
| UK | 2 174 | 1 799 | 1 499 | 1 680 | 1 950 | 249 | 1 050 | 1 005 | 1 649 | 13 059 |
| EU-27 | 8 537 | 11 590 | 10 608 | 7 103 | 8 206 | 5 303 | 7 303 | 5 084 | 8 531 | 72 403 |
| NO | 68 | 172 | 256 | 78 | 196 | 39 | 83 | 75 | 46 | 1 014 |
| CH | 54 | 376 | 394 | 189 | 273 | 103 | 259 | 105 | 139 | 1 892 |
| EU-27+ | 8 659 | 12 138 | 11 258 | 7 369 | 8 676 | 5 445 | 7 646 | 5 263 | 8 716 | 75 309 |

NB: Visit http://www.cedefop.europa.eu/EN/about-cedefop/projects/forecasting-skill-demand-and-supply/skills-forecasts.aspx for possible updates of this table.
*Source*: Cedefop (IER estimates).

Table 19 **Total job openings by country and occupation, 2010-20 (in thousands)**

*Overall requirement (thousands)*

| Occupation major group 2010-20 | Legislators, senior officials and managers | Professionals | Technicians and associate professionals | Clerks | Service workers and shop and market sales workers | Skilled agricultural and fishery workers | Craft and related trades workers | Plant and machine operators and assemblers | Elementary occupations | All |
|---|---|---|---|---|---|---|---|---|---|---|
| BE | 248 | 375 | 247 | 148 | 204 | 47 | - 16 | 172 | 171 | 1 589 |
| BG | 38 | 148 | 131 | 90 | 137 | 142 | 43 | 96 | 259 | 1 082 |
| CZ | 137 | 276 | 597 | 78 | 140 | 18 | 152 | 174 | 124 | 1 694 |
| DK | 103 | 278 | 362 | 49 | 115 | 30 | 89 | 70 | 101 | 1 196 |
| DE | 1 040 | 2 951 | 2 916 | 1 280 | 1 653 | 272 | 1 185 | 829 | 1 743 | 13 835 |
| EE | 30 | 41 | 24 | 15 | 26 | 1 | 17 | 32 | 36 | 220 |
| IE | 152 | 53 | 64 | 12 | 61 | 4 | 77 | 41 | 79 | 541 |
| EL | 186 | 241 | 190 | 103 | 231 | 285 | 78 | 104 | 160 | 1 580 |
| ES | 828 | 894 | 1 355 | 525 | 1 304 | 168 | 518 | 615 | 1 070 | 7 285 |
| FR | 1 360 | 2 047 | 1 961 | 491 | 1 090 | 475 | 467 | 289 | 1 892 | 10 033 |
| IT | 1 891 | 1 321 | 2 222 | 635 | - 24 | 210 | 937 | 358 | 941 | 8 584 |
| CY | 24 | 18 | 15 | 18 | 14 | 10 | 13 | 6 | 30 | 147 |
| LV | 34 | 83 | 51 | 15 | 33 | 3 | 42 | 28 | 57 | 348 |
| LI | 29 | 150 | 73 | 1 | 48 | 32 | 49 | 24 | 46 | 455 |
| LU | 10 | 60 | 18 | 26 | 9 | 2 | 2 | 1 | 10 | 139 |
| HU | 143 | 260 | 121 | 80 | 117 | 46 | 12 | 161 | 160 | 1 087 |
| MT | 5 | 13 | 11 | 3 | 13 | 1 | 8 | 1 | 4 | 59 |
| NL | 377 | 820 | 404 | 329 | 447 | 14 | 153 | 115 | 291 | 2 947 |
| AT | 100 | 184 | 250 | 68 | 194 | 132 | 20 | 22 | 233 | 1 205 |
| PL | 336 | 803 | 437 | 138 | 36 | 328 | 417 | 153 | 213 | 2 838 |
| PT | 183 | 276 | 148 | 99 | 257 | 360 | 158 | 138 | 321 | 1 933 |
| RO | - 38 | 585 | 58 | 60 | 369 | 1 317 | - 71 | 289 | 523 | 3 059 |
| SI | 52 | 87 | 50 | - 3 | 6 | 21 | 25 | 3 | 65 | 309 |
| SK | 67 | 122 | 154 | 14 | 76 | 3 | 94 | 65 | 74 | 686 |
| FI | 101 | 184 | 151 | 12 | 87 | 60 | 90 | 68 | 97 | 846 |
| SE | 158 | 468 | 423 | 95 | 337 | 51 | 164 | 175 | 115 | 1 984 |
| UK | 2 518 | 1 317 | 2 963 | 1 050 | 2 216 | 368 | 771 | 1 005 | 2 176 | 14 350 |
| EU-27 | 10 112 | 14 056 | 15 395 | 5 431 | 9 197 | 4 401 | 5 496 | 5 031 | 10 993 | 80 030 |
| NO | 37 | 298 | 398 | 47 | 284 | 22 | 94 | 67 | 38 | 1 285 |
| CH | 65 | 603 | 476 | 105 | 365 | 118 | 311 | 143 | 184 | 2 371 |
| EU-27+ | 10 215 | 14 957 | 16 269 | 5 583 | 9 845 | 4 540 | 5 901 | 5 241 | 11 216 | 83 686 |

NB: Visit http://www.cedefop.europa.eu/EN/about-cedefop/projects/forecasting-skill-demand-and-supply/skills-forecasts.aspx for possible updates of this table.
*Source*: Cedefop (IER estimates).

Table 20 **Replacement demand by country and qualification, unconstrained, 2010-20 (in thousands)**

*Levels (thousands)*

| | All qualifications | | | | Low qualifications | | | | Medium qualifications | | | | High qualifications | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2010 | Change 2010-20 | Replace-ment needs | Total require-ements | 2010 | Change 2010-20 | Replace-ment needs | Total require-ments | 2010 | Change 2010-20 | Replace ment needs | Total require ments | 2010 | Change 2010-20 | Replac ement needs | Total requirem ents |
| BE | 4 467 | 360 | 1 228 | 1 589 | 893 | - 172 | 239 | 67 | 1 767 | 238 | 476 | 714 | 1 807 | 295 | 513 | 808 |
| BG | 3 558 | - 5 | 1 087 | 1 082 | 657 | - 158 | 242 | 83 | 1 984 | 61 | 576 | 638 | 917 | 92 | 268 | 360 |
| CZ | 5 156 | 162 | 1 532 | 1 694 | 312 | - 47 | 105 | 58 | 3 781 | - 113 | 1 088 | 975 | 1 063 | 322 | 339 | 661 |
| DK | 2 804 | 116 | 1 079 | 1 196 | 769 | 160 | 287 | 447 | 1 107 | - 165 | 419 | 254 | 929 | 121 | 374 | 495 |
| DE | 40 490 | - 243 | 14 078 | 13 835 | 5 828 | - 379 | 2 019 | 1 639 | 23 823 | 90 | 7 978 | 8 068 | 10 839 | 47 | 4 081 | 4 128 |
| EE | 575 | 42 | 179 | 220 | 63 | 12 | 21 | 33 | 280 | 17 | 87 | 104 | 233 | 12 | 71 | 83 |
| IE | 1 844 | 103 | 438 | 541 | 384 | - 116 | 110 | - 6 | 722 | 95 | 167 | 262 | 738 | 124 | 161 | 285 |
| EL | 4 658 | 184 | 1 396 | 1 580 | 1 577 | - 384 | 584 | 199 | 1 800 | 286 | 476 | 763 | 1 281 | 282 | 337 | 618 |
| ES | 18 700 | 929 | 6 356 | 7 285 | 7 279 | -2 345 | 2 495 | 151 | 4 693 | 1 511 | 1 552 | 3 063 | 6 728 | 1 762 | 2 309 | 4 071 |
| FR | 25 417 | 2 149 | 7 884 | 10 033 | 5 657 | - 959 | 1 745 | 786 | 10 876 | 240 | 3 231 | 3 471 | 8 884 | 2 868 | 2 908 | 5 777 |
| IT | 24 658 | 796 | 7 788 | 8 584 | 8 961 | -1 635 | 2 758 | 1 123 | 11 253 | 1 471 | 3 325 | 4 796 | 4 445 | 960 | 1 705 | 2 665 |
| CY | 392 | 53 | 94 | 147 | 93 | - 17 | 29 | 12 | 151 | 21 | 36 | 57 | 147 | 49 | 29 | 78 |
| LV | 930 | 81 | 267 | 348 | 125 | 45 | 40 | 85 | 519 | - 32 | 148 | 116 | 287 | 69 | 79 | 147 |
| LI | 1 342 | 87 | 368 | 455 | 103 | 5 | 31 | 36 | 740 | 126 | 198 | 324 | 499 | - 45 | 139 | 95 |
| LU | 357 | 33 | 106 | 139 | 88 | - 27 | 24 | - 3 | 152 | 25 | 43 | 68 | 117 | 35 | 39 | 74 |
| HU | 4 006 | 168 | 919 | 1 087 | 509 | - 66 | 118 | 51 | 2 390 | - 52 | 521 | 468 | 1 107 | 287 | 281 | 568 |
| MT | 166 | 3 | 56 | 59 | 89 | - 18 | 30 | 12 | 36 | 13 | 12 | 24 | 40 | 8 | 15 | 23 |
| NL | 8 589 | 432 | 2 514 | 2 947 | 2 171 | - 240 | 608 | 368 | 3 592 | - 65 | 1 006 | 940 | 2 826 | 738 | 900 | 1 638 |
| AT | 4 120 | 159 | 1 046 | 1 205 | 699 | - 65 | 187 | 122 | 2 559 | - 44 | 610 | 566 | 862 | 268 | 249 | 517 |
| PL | 15 861 | - 53 | 2 892 | 2 838 | 1 826 | - 65 | 390 | 325 | 9 251 | -1 266 | 1 657 | 391 | 4 784 | 1 278 | 845 | 2 123 |
| PT | 4 940 | 91 | 1 842 | 1 933 | 3 036 | - 452 | 1 215 | 763 | 891 | 359 | 285 | 644 | 1 013 | 184 | 342 | 525 |
| RO | 9 007 | 129 | 2 931 | 3 059 | 2 161 | - 371 | 1 260 | 888 | 5 144 | 39 | 1 343 | 1 382 | 1 702 | 461 | 328 | 789 |
| SI | 950 | 22 | 287 | 309 | 147 | - 23 | 64 | 40 | 508 | - 29 | 137 | 108 | 294 | 75 | 87 | 161 |
| SK | 2 155 | 169 | 517 | 686 | 108 | - 16 | 29 | 14 | 1 516 | - 23 | 343 | 320 | 531 | 208 | 144 | 352 |
| FI | 2 443 | 80 | 765 | 846 | 373 | - 76 | 123 | 47 | 1 104 | 46 | 341 | 387 | 966 | 110 | 302 | 411 |
| SE | 4 496 | 290 | 1 694 | 1 984 | 820 | 33 | 298 | 331 | 2 194 | 122 | 796 | 918 | 1 482 | 134 | 600 | 734 |
| UK | 31 137 | 1 290 | 13 059 | 14 350 | 6 655 | -2 954 | 2 922 | - 32 | 13 727 | 2 156 | 5 772 | 7 928 | 10 754 | 2 089 | 4 365 | 6 454 |
| EU-27 | 223 219 | 7 627 | 72 403 | 80 030 | 51 381 | -10 331 | 17 970 | 7 639 | 106 560 | 5 128 | 32 622 | 37 750 | 65 278 | 12 830 | 21 811 | 34 641 |
| NO | 2 537 | 270 | 1 014 | 1 285 | 612 | 257 | 230 | 487 | 1 023 | - 170 | 390 | 219 | 902 | 183 | 395 | 578 |
| CH | 4 551 | 479 | 1 872 | 2 352 | 779 | 82 | 325 | 407 | 2 328 | - 124 | 950 | 826 | 1 444 | 521 | 597 | 1 118 |
| EU-27+ | 230 308 | 8 377 | 75 290 | 83 666 | 52 772 | -9 992 | 18 525 | 8 533 | 109 912 | 4 834 | 33 962 | 38 796 | 67 624 | 13 535 | 22 803 | 36 338 |

NB: Visit http://www.cedefop.europa.eu/EN/about-cedefop/projects/forecasting-skill-demand-and-supply/skills-forecasts.aspx for possible updates of this table.
*Source*: Cedefop (IER estimates).

ANNEX III.

# Classifications and aggregations used

## Industries and sectors

**Aggregation of NACE Rev 1.1 two and three digit industries to 41 industries**

| 41-industry [NACE] | | NACE Rev 1.1 [NACE] |
|---|---|---|
| 1 | Agriculture, etc.[01-05] | Agriculture, hunting and related service activities [01] |
| | | Forestry, logging and related service activities [02] |
| | | Fishing, fish farming and related service activities [05] |
| 2 | Coal [10] | Mining of coal and lignite; extraction of peat [10] |
| 3 | Oil and gas, etc.[11, 12] | Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying [11] |
| | | Mining of uranium and thorium ores [12] |
| 4 | Other mining [13, 14] | Mining of metal ores [13] |
| | | Other mining and quarrying [14] |
| 5 | Food, drink and tobacco [15, 16] | Manufacture of food products and beverages [15] |
| | | Manufacture of tobacco products [16] |
| 6 | Textiles, clothing and leather [17-19] | Manufacture of textiles [17] |
| | | Manufacture of wearing apparel; dressing and dyeing of fur [18] |
| | | Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear [19] |
| 7 | Wood and paper [20, 21] | Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials [20] |
| | | Manufacture of pulp, paper and paper products [21] |
| 8 | Printing and publishing [22] | Publishing, printing and reproduction of recorded media [22] |
| 9 | Manufactured fuels [23] | Manufacture of coke, refined petroleum products and nuclear fuel [23] |
| 10 | Pharmaceuticals [24.4] | Manufacture of pharmaceuticals, medicinal chemicals and botanical products [24.4] |
| 11 | Chemicals nes [24(ex24.4)] | Manufacture of chemicals and chemical products (except pharmaceuticals, etc.) [24 (ex 24.4)] |
| 12 | Rubber and plastics [25] | Manufacture of rubber and plastic products [25] |
| 13 | Non-metallic mineral products [26] | Manufacture of other non-metallic mineral products [26] |
| 14 | Basic metals [27] | Manufacture of basic metals [27] |
| 15 | Metal goods [28] | Manufacture of fabricated metal products, except machinery and equipment [28] |
| 16 | Mechanical engineering [29] | Manufacture of machinery and equipment n.e.c. [29] |
| 17 | Electronics [30, 32] | Manufacture of office machinery and computers [30] |
| | | Manufacture of radio, television and communication equipment and apparatus [32] |

| 41-industry [NACE] | | NACE Rev 1.1 [NACE] |
|---|---|---|
| 18 | Electrical engineering and instruments [31, 33] | Manufacture of electrical machinery and apparatus n.e.c. [31] |
| | | Manufacture of medical, precision and optical instruments, watches and clocks [33] |
| 19 | Motor vehicles [34] | Manufacture of motor vehicles, trailers and semi-trailers [34] |
| 20 | Other transport equipment [35] | Manufacture of other transport equipment [35] |
| 21 | Manufacturing nes [36, 37] | Manufacture of furniture; manufacturing n.e.c. [36] |
| | | Recycling [37] |
| 22 | Electricity [40.1, 40.3] | Electricity, steam and hot water supply [40.1, 40.3] |
| 23 | Gas supply [40.2] | Manufacture of gas; distribution of gaseous fuels through mains [40.2] |
| 24 | Water supply [41] | Collection, purification and distribution of water [41] |
| 25 | Construction [45] | Construction [45] |
| 26 | Distribution [50, 51] | Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel [50] |
| | | Wholesale trade and commission trade, except of motor vehicles and motorcycles [51] |
| 27 | Retailing [52] | Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods [52] |
| 28 | Hotels and catering [55] | Hotels and restaurants [55] |
| 29 | Land transport, etc.[60, 63] | Land transport; transport via pipelines [60] |
| | | Supporting and auxiliary transport activities; activities of travel agencies [63] |
| 30 | Water transport [61] | Water transport [61] |
| 31 | Air transport [62] | Air transport [62] |
| 32 | Communications [64] | Post and telecommunications [64] |
| 33 | Banking and finance [65, 67] | Financial intermediation, except insurance and pension funding [65] |
| | | Activities auxiliary to financial intermediation [67] |
| 34 | Insurance [66] | Insurance and pension funding, except compulsory social security [66] |
| 35 | Computing services [72] | Computer and related activities [72] |
| 36 | Professional services [70, 71, 73, 74.1-74.4] | Real estate activities [70] |
| | | Renting of machinery and equipment without operator and of personal and household goods [71] |
| | | Research and development [73] |
| | | Other business activities (professional services) [74.1-74.4] |
| 37 | Other Business services [74.5-74.8] | Other business activities (business services) [74.5-74.8] |
| 38 | Public administration and Defence [75] | Public administration and defence; compulsory social security [75] |
| 39 | Education [80] | Education [80] |
| 40 | Health and social work [85] | Health and social work [85] |

| 41-industry [NACE] | | NACE Rev 1.1 [NACE] |
|---|---|---|
| 41 | Miscellaneous services [90-93, 95-97, 99] | Sewage and refuse disposal, sanitation and similar activities [90] |
| | | Activities of membership organisations n.e.c. [91] |
| | | Recreational, cultural and sporting activities [92] |
| | | Other service activities [93] |
| | | Activities of households as employers of domestic staff [95] |
| | | Undifferentiated goods producing activities of private households for own use [96] |
| | | Undifferentiated services producing activities of private households for own use [97] |
| | | Extra-territorial organisations and bodies [99] |

*Source:* http://forum.europa.eu.int/irc/dsis/employment/info/data/eu_lfs/Related_documents/Nace_Rev_1.1.htm.

## Aggregation of 41-industry to 6-industry

| 6-industry [NACE] | | 41-industry [NACE] | |
|---|---|---|---|
| 1 | Primary sector and utilities [01-14, 40, 41] | 1 | Agriculture, etc.[01-05] |
| | | 2 | Coal [10] |
| | | 3 | Oil and gas, etc.[11, 12] |
| | | 4 | Other mining [13, 14] |
| | | 22 | Electricity [40.1, 40.3] |
| | | 23 | Gas supply [40.2] |
| | | 24 | Water supply [41] |
| 2 | Manufacturing [15-37] | 5 | Food, drink and tobacco [15, 16] |
| | | 6 | Textiles, clothing and leather [17-19] |
| | | 7 | Wood and paper [20, 21] |
| | | 8 | Printing and publishing [22] |
| | | 9 | Manufactured fuels [23] |
| | | 10 | Pharmaceuticals [24.4] |
| | | 11 | Chemicals nes [24(ex24.4)] |
| | | 12 | Rubber and plastics [25] |
| | | 13 | Non-metallic mineral products [26] |
| | | 14 | Basic metals [27] |
| | | 15 | Metal goods [28] |
| | | 16 | Mechanical engineering [29] |
| | | 17 | Electronics [30, 32] |
| | | 18 | Electrical engineering and instruments [31, 33] |
| | | 19 | Motor vehicles [34] |
| | | 20 | Other transport equipment [35] |
| | | 21 | Manufacturing nes [36, 37] |
| 3 | Construction [45] | 25 | Construction [45] |

| | | | |
|---|---|---|---|
| 4 | Distribution and transport [50-64] | 26 | Distribution [50, 51] |
| | | 27 | Retailing [52] |
| | | 28 | Hotels and catering [55] |
| | | 29 | Land transport, etc.[60, 63] |
| | | 30 | Water transport [61] |
| | | 31 | Air transport [62] |
| | | 32 | Communications [64] |
| 5 | Business and other services [65-74, 90-99] | 33 | Banking and finance [65, 67] |
| | | 34 | Insurance [66] |
| | | 35 | Computing services [72] |
| | | 36 | Professional services [70, 71, 73, 74.1-74.4] |
| | | 37 | Other Business services [74.5-74.8] |
| | | 41 | Miscellaneous services [90-93, 95, 99] |
| 6 | Non-marketed services [75, 80, 85] | 38 | Public administration and defence [75] |
| | | 39 | Education [80] |
| | | 40 | Health and social work [85] |

# Occupations

## ISCO

| | |
|---|---|
| **Major group 1: legislators, senior officials and managers** | |
| 11 | Legislators and senior officials |
| 12 | Corporate managers |
| 13 | Managers of small enterprises |
| **Major group 2: professionals** | |
| 21 | Physical, mathematical and engineering science professionals |
| 22 | Life science and health professionals |
| 23 | Teaching professionals |
| 24 | Other professionals |
| **Major group 3: technicians and associate professionals** | |
| 31 | Physical and engineering science associate professionals |
| 32 | Life science and health associate professionals |
| 33 | Teaching associate professionals |
| 34 | Other associate professionals |
| **Major group 3: clerks** | |
| 41 | Office clerks |
| 42 | Customer services clerks |
| **Major group 4: service workers and shop and market sales workers** | |
| 51 | Personal and protective services workers |
| 52 | Models, salespersons and demonstrators |
| **Major group 6: Skilled agricultural and fishery workers** | |
| 61 | Skilled agricultural and fishery workers |
| **Major group 7: craft and related trades workers** | |
| 71 | Extraction and building trades workers |

| | |
|---|---|
| 72 | Metal, machinery and related trades workers |
| 73 | Precision, handicraft, craft printing and related trades workers |
| 74 | Other craft and related trades workers |
| **Major group 8: plant and machine operators and assemblers** | |
| 81 | Stationary plant and related operators |
| 82 | Machine operators and assemblers |
| 83 | Drivers and mobile plant operators |
| **Major group 9: elementary occupations** | |
| 91 | Sales and services elementary occupations |
| 92 | Agricultural, fishery and related labourers |
| 93 | Labourers in mining, construction, manufacturing and transport |
| **Major group 0: armed forces** | |

# Qualifications

| **Level of qualification** | |
|---|---|
| Low | (Pre)primary and lower secondary (ISCED 0-2) |
| Medium | Upper and post-secondary (ISCED 3-4) |
| High | Tertiary (ISCED 5-6) |

**ISCED 0: pre-primary education**

Programmes at level 0, (pre-primary) defined as the initial stage of organised instruction, are designed primarily to introduce young children to a school-type environment, i.e. to provide a bridge between the home and a school-based atmosphere. Upon completion of these programmes, children continue their education at level 1 (primary education).

**ISCED 1: primary education or first stage of basic education**

Programmes at level 1 are normally designed on a unit or project basis to give students a sound basic education in reading, writing and mathematics along with an elementary understanding of other subjects such as history, geography, natural science, social science, art and music. In some cases religious instruction is featured. The core at this level consists of education provided for children, the customary or legal age of entrance being not younger than five years or older than seven years. This level covers, in principle, six years of full-time schooling.

**ISCED 2: lower secondary education or second stage of basic education**

The contents of education at this stage are typically designed to complete the provision of basic education which began at ISCED 1. In many, if not most countries, the educational aim is to lay the foundation for lifelong learning and human development. The programmes at this level are usually on a more subject

oriented pattern using more specialised teachers and more often several teachers conducting classes in their field of specialisation. The full implementation of basic skills occurs at this level. The end of this level often coincides with the end of compulsory schooling where it exists.

**ISCED 3: upper secondary education**

This level of education typically begins at the end of full-time compulsory education for those countries that have a system of compulsory education. More specialisation may be observed at this level than at ISCED 2 and often teachers need to be more qualified or specialised than for ISCED 2. The entrance age to this level is typically 15 to 16 years. The educational programmes included at this level typically require the completion of some nine years of full-time education (since the beginning of level 1) for admission or a combination of education and vocational or technical experience.

ISCED 3A: programmes designed to provide direct access to ISCED 5A;

ISCED 3B: programmes designed to provide direct access to ISCED 5B;

ISCED 3C: programmes not designed to lead to ISCED 5A or 5B.

ISCED 4: post-secondary non tertiary education

ISCED 4 captures programmes that straddle the boundary between upper secondary and post-secondary education from an international point of view, even though they might clearly be considered as upper secondary or post-secondary programmes in a national context. These programmes can, considering their content, not be regarded as tertiary programmes. They are often not significantly more advanced than programmes at ISCED 3 but they serve to broaden the knowledge of participants who have already completed a programme at level 3.

Typical examples are programmes designed to prepare students for studies at level 5 who, although having completed ISCED 3, did not follow a curriculum which would allow entry to level 5, i.e. pre-degree foundation courses or short vocational programmes. Second cycle programmes can be included as well.

ISCED 4A: see text for ISCED 3

ISCED 4B: see text for ISCED 3

ISCED 4C: see text for ISCED 3

**ISCED 5: first stage of tertiary education (not leading directly to an advanced research qualification)**

This level consists of tertiary programmes having an educational content more advanced than those offered at levels 3 and 4. Entry to these programmes normally requires the successful completion of ISCED 3A or 3B or a similar qualification at ISCED 4A. They do not lead to the award of an advanced

research qualification (ISCED 6). These programmes must have a cumulative duration of at least two years.

ISCED 5A: programmes that are largely theoretically based and are intended to provide sufficient qualifications for gaining entry into advanced research programmes and professions with high skills requirements.

ISCED 5B: programmes that are practically oriented/occupationally specific and are mainly designed for participants to acquire the practical skills and know-how needed for employment in a particular occupation or trade or class of occupations or trades, the successful completion of which usually provides the participants with a labour-market relevant qualification.

**ISCED 6: second stage of tertiary education (leading to an advanced research qualification)**

This level is reserved for tertiary programmes which lead to the award of an advanced research qualification. The programmes are, therefore, devoted to advanced study and original research and not based on course-work only. They typically require the submission of a thesis or dissertation of publishable quality which is the product of original research and represents a significant contribution to knowledge. They prepare graduates for faculty posts in institutions offering ISCED 5A programmes, as well as research posts in government, industry, etc.

Documentation by EU-LFS: levels of education and training ISCED 1997 http://circa.europa.eu/irc/dsis/employment/info/data/eu_lfs/Related_documents/ISCED_EN.htm.

ANNEX IV.

# Contributing country experts

| | | |
|---|---|---|
| **Austria** | Julia Bock-Schappelwein | WIFO, Austrian Institute of Economic Research |
| | Robert Stehrer | WIIW, Vienna Institute for International Economic Studies |
| **Belgium** | Koen Hendrickx | Federal Planning Bureau |
| | Terry Ward | Alphametrics Ltd |
| **Bulgaria** | Iskren Angelov | MLSP, Ministry of Labour and Social Policy |
| | Elka Dimitrova | |
| **Croatia** | Danijel Nestić | Institute of Economics, Zagreb |
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ANNEX V.

# Acronyms and definitions

## Country codes

| | |
|---|---|
| BE | Belgium |
| BG | Bulgaria |
| CZ | Czech Republic |
| DK | Denmark |
| DE | Germany |
| EE | Estonia |
| IE | Ireland |
| EL | Greece |
| ES | Spain |
| FR | France |
| IT | Italy |
| CY | Cyprus |
| LV | Latvia |
| LT | Lithuania |
| LU | Luxembourg |

| | |
|---|---|
| HU | Hungary |
| MT | Malta |
| NL | Netherlands |
| AT | Austria |
| PL | Poland |
| PT | Portugal |
| RO | Romania |
| SI | Slovenia |
| SK | Slovakia |
| FI | Finland |
| SE | Sweden |
| UK | United Kingdom |

| | |
|---|---|
| NO | Norway |
| CH | Switzerland |

## Institutions and organisations

| | |
|---|---|
| EU | European Union |
| Eurostat | Statistical Office of the European Communities |
| IER | Institute for Employment Research |
| OECD | Organisation for Economic Cooperation and Development |
| ROA | Researchcentrum voor Onderwijs en Arbeidsmarkt<br>[Research centre for education and the labour market] |
| Skillsnet | Cedefop's network on early identification of skill needs |

## Others

| | |
|---|---|
| MC | measure of constraint |
| BalMod | module to reconcile skill supply and demand projections |
| EDMOD | module to produce occupational demand projections (expansion demands) |
| ESA | European system of integrated economic accounts |
| EU-LFS | European labour force survey |
| EU-27 | The 27 EU Member States |
| EU-27+ | The 27 EU Member States plus Norway and Switzerland |
| GDP | gross domestic product |
| IFIOD | indicator of future imbalances on demand |
| IFOD | indicator for future difficulty on demand |
| ISCED | international standard classification of education |
| ISCO | international standard classification of occupations |
| LFS | labour force survey |
| NACE | Nomenclature statistique des activités économiques dans la Communauté européenne [statistical classification of economic activities in the European Community] |
| p.a. | per annum |
| QMOD | module to produce qualification projections |
| StockMod | module of numbers acquiring qualifications (stocks) |

## Definitions of terms used

| | |
|---|---|
| Conceptual framework | The general theoretical and methodological approach to modelling and projecting the demand for and supply of skills. |
| Employment | The number of people in work (head count), national accounts definition, (or the number of jobs in some cases), Split by various dimensions, including sector, occupation, gender and highest qualification held. |
| Labour force | The number of people economically active (the sum over the various age ranges of the working age population * the relevant labour market participation rate) which includes employed and unemployed. |
| Population (15+) | Anyone of age 15 or over is classified as part of the population in the context of the model. People over 65 are included in this definition, as these age groups have participation rates greater than zero. |
| Working age population | Anyone of age 15-64 is classified as part of the working-age population. |
| Participation or activity rate | The percentage of the population that is either employed or unemployed (International Labour Organisation definition of labour force). This is differentiated by gender and age group. |
| Qualifications | This term refers to the highest level of education/qualification held by the individual. The ISCED is used for this purpose. The most aggregate level distinguishes three main levels of education/qualification: high (ISCED 5-6), medium (ISCED 3-4, excluding 3c short) and low (ISCED 0-2, plus 3c short). |
| Demand | In the context of the model, labour demand is taken to be the same as employment levels (number of jobs available). It does not include (for example) unfilled vacancies. |
| Supply | In the context of the model, labour supply is taken to be the same as the labour force. |

CEDEFOP | European Centre for the Development of Vocational Training

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# Future skills supply and demand in Europe

## Forecast 2012

The 2008 financial crisis and the persistent economic downturn that has followed have had a major impact on the European labour market. Taking their effects into account, Cedefop has produced its latest forecast for skill labour supply and demand up to 2020.

Cedefop's forecasts are unique in making a comparative analysis of the major trends in employment growth and decline for sectors, occupations and qualifications both across the European labour market as a whole and for individual European Union Member States.

According to the forecasts, assuming a slow but steady recovery, up to 2020, the European economy will create some eight million new jobs. However, nearly 10 times as many jobs, around 75 million, will need to be filled as people retire or leave the workforce. Although there will be job openings for all types of occupations, most new jobs will be at the higher and lower end of the skill spectrum bringing a risk of job polarisation. Weak employment growth indicates that there may be an oversupply of people with high-level qualifications in the short term, but by 2020, Europe will have the most highly-qualified workforce in its history. This publication provides the data behind these trends and discusses the challenges they pose for policy-makers.

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