



CEDEFOP

European Centre for the Development  
of Vocational Training

EN

# FUTURE SKILL NEEDS



IN EUROPE

FOCUS ON **2020**

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# Table of contents

Foreword .....	1
Acknowledgements .....	2
1. Introduction .....	5
2. Methodology and data issues .....	6
3. Employment trends by 2020.....	7
3.1. Services sector still expanding .....	7
3.2. Around 20 million new jobs by 2020.....	8
3.3. Workforce shortages in 2020.....	9
3.4. High and medium-skilled occupations on the rise .....	10
3.5. Polarisation of jobs as high and low-level occupations increase .....	11
3.6. Increase in qualification levels .....	12
4. Policy implications .....	14
5. Conclusions .....	15
Annex A: Tables for EU-25 <sup>+</sup> (EU-25, Norway and Switzerland).....	16
Annex B: Tables for EU-25.....	18
Annex C: Classifications and aggregations used .....	20
Bibliography and other references .....	25

# List of tables and figures

Table A.1: Employment by broad sector, EU-25 <sup>+</sup> .....	16
Table A.2: Employment change by broad sector, EU-25 <sup>+</sup> .....	16
Table A.3: Employment by occupation, EU-25 <sup>+</sup> .....	16
Table A.4: Demand by occupation, 2006-20, EU-25 <sup>+</sup> .....	17
Table A.5: Employment by qualification, EU-25 <sup>+</sup> .....	17
Table A.6: Demand by qualification, 2006-20, EU-25 <sup>+</sup> .....	17
Table A.7: Employment shares by qualification, EU-25 <sup>+</sup> .....	17
Table A.8: Employment change by qualification, EU-25 <sup>+</sup> .....	17
Table B.1: Employment by broad sector, EU-25 .....	18
Table B.2: Employment change by broad sector, EU-25 .....	18
Table B.3: Employment by occupation, EU-25 .....	18
Table B.4: Demand by occupation, 2006-20, EU-25 .....	19
Table B.5: Employment by qualification, EU-25 .....	19
Table B.6: Demand by qualification, 2006-20, EU-25 .....	19
Table B.7: Employment shares by qualification, EU-25 .....	19
Table B.8: Employment change by qualification, EU-25 .....	19

## Figures

Figure 1: Past and likely future employment trends by broad sector, EU-25 <sup>+</sup> .....	7
Figure 2: Employment trends by broad sector change in millions, EU-25 <sup>+</sup> .....	8
Figure 3: Employment trends by broad sector, shares in %, EU-25 <sup>+</sup> .....	9
Figure 4: Demand by occupation, broad groups, projected change 2006-20 in millions, EU-25 <sup>+</sup> .....	10
Figure 5: Changes in the composition of qualification levels of elementary occupations, 1996-2006 and the projection up to 2020, in %, EU-25 <sup>+</sup> .....	11
Figure 6: Past and likely future qualification structure of jobs, shares in % EU-25 <sup>+</sup> .....	12
Figure 7: Total requirement by qualification level, projected change 2006-20, in millions EU-25 <sup>+</sup> .....	13

## 1. INTRODUCTION

Future skill needs are high on Europe's policy agenda. The relaunched Lisbon strategy and other policy documents stress the need for Europe to do more to anticipate changing skill needs. This is seen as a priority for the next decade.

In November 2007, the Education Council adopted a resolution on 'New skills for new jobs'. It emphasised the need to raise overall skill levels and anticipate emerging skill needs and skill gaps in European labour markets. It also called for a better matching of knowledge, skills and competences to social and economic needs. The resolution aims to strengthen identification, at European level, of new types of jobs and skill needs. It proposes developing regular medium-term foresight of skill needs and identification of skill gaps. In February 2008, Cedefop published a medium-term forecast of occupational skill needs in Europe for the period 2006-15 <sup>(1)</sup>.

The March 2008 European Council 'invite[d] the Commission to present a comprehensive assessment of the future skills requirements in Europe up to 2020, taking account of the impacts of technological change and ageing populations and to propose steps to anticipate future needs'.

To support the European Commission in preparing its communication, 'New skills for new jobs', Cedefop reviewed its earlier forecast and extended the time horizon from 2015 to 2020. The updated findings are outlined in this booklet.

The longer the time horizon, the more likely the results will be inaccurate. Forecasting rules stipulate that the forecasting period should not exceed the past time series on which the forecast is based. Past time series earlier than 1996 are not available for many Member States. Inevitably, data provided are rather general and should be treated cautiously. They are based on aggregated results at European level for 25 EU Member States plus Norway and Switzerland (EU-25<sup>+</sup>). They cover six broad sectors (NACE), nine broad occupational groups (ISCO), and three broad levels of formal qualifications (ISCED). They represent only the baseline forecast constructed from a set of European Commission economic projections <sup>(2)</sup>.

To complement the skill needs forecast Cedefop is working on a forecast of skill supply and an analysis of possible labour market imbalances. Results are expected in early 2009.

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<sup>(1)</sup> Cedefop. *Future skill needs in Europe. Medium-term forecast: synthesis report*. Luxembourg: Publications Office, 2008. Available from Internet:  
[http://www.trainingvillage.gr/etv/Information\\_resources/Bookshop/publication\\_details.asp?pub\\_id=485](http://www.trainingvillage.gr/etv/Information_resources/Bookshop/publication_details.asp?pub_id=485)

<sup>(2)</sup> Alternative scenarios were not constructed for this time horizon. However, it should be kept in mind that there is certain sensitivity and uncertainty in the forecast provided. For example, the alternative scenarios developed for the 2015 projection suggested that the overall increase in jobs will be between 7.5 million and 17.5 million jobs (for EU-25 plus Norway and Switzerland).

## **2. METHODOLOGY AND DATA ISSUES**

To develop the results of the skill needs forecast, a modular approach was used comprising four main elements: a multisectoral macroeconomic model, occupational and qualifications expansion demand modules, and a replacement demand module.

This forecast is based on data from Eurostat sources, adopting common methods and models. This required developing a basic database and tools for a comprehensive and consistent set of skill projections for EU-25<sup>+</sup>. The modular framework makes it possible to refine the modelling approaches used for projecting demand by occupation and qualification, and replacement demand. It also allows for data to be refined for countries or sectors where there are concerns about its quality and robustness, or to incorporate new data and alternative assumptions.

A key issue for the forecast is use of the best data to measure employment structures in Europe using a common framework. Historically, most countries have invested considerable resources in developing data for their national accounts (NAs). Estimates of employment on this basis are consistent with other key economic indicators such as output and productivity. More recently, however, greater emphasis has been placed on estimates of employment based on the European labour force survey (LFS). Their advantage is that they are broadly consistent across countries and provide a measure of employment structure by skills (for example occupation and qualification).

The numbers presented by sector, as used in the multisectoral macroeconomic model, are based on Eurostat national accounts, rather than LFS-based estimates. There are some significant discrepancies between these two sources which remain unresolved. These reflect sampling problems and other differences arising from the different methods used to collect the different datasets.

### 3. EMPLOYMENT TRENDS BY 2020

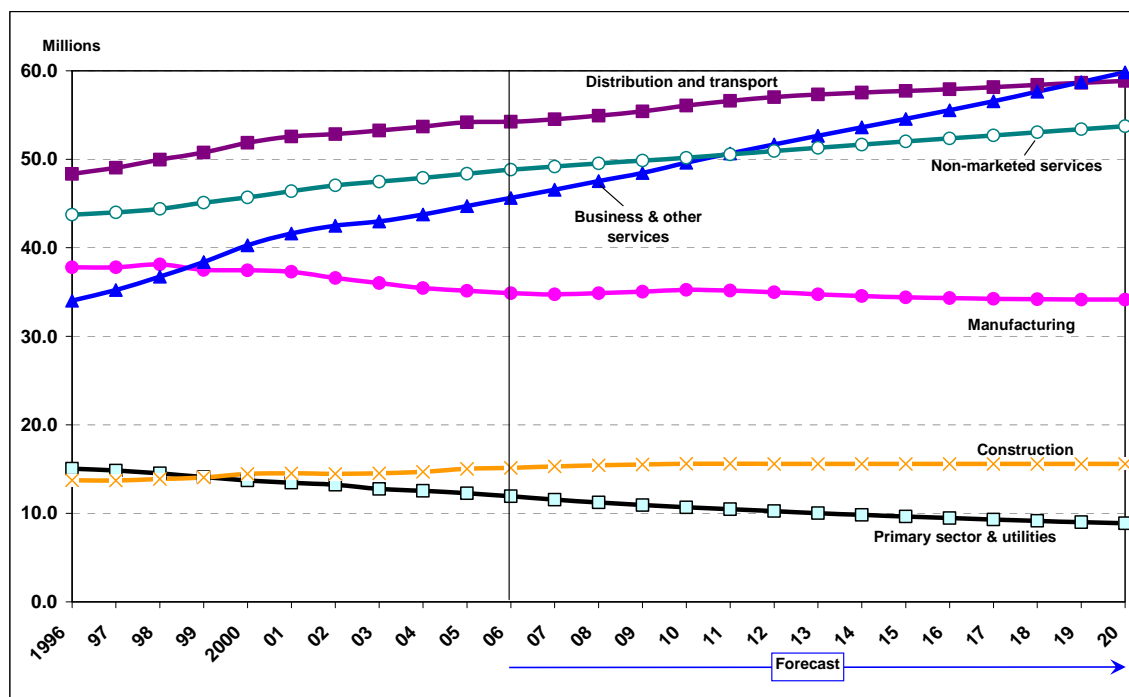
#### 3.1. Services sector still expanding

Europe has experienced a general shift away from the primary sector (especially agriculture) and traditional manufacturing industries towards services and the knowledge-intensive economy. The forecast results confirm that this trend is likely to continue as a key feature over the coming decade both nationally and across Europe (Figure 1).

Although employment in many new EU Member States still relies to a great extent on agriculture and manufacturing, there are clear signs that this is changing rapidly. In part this is an internal process, specific to each country. It reflects shifting patterns of activity and people across borders, as capital and labour adjust to changing political and economic situations. In some countries changes are in the opposite direction, as activities in manufacturing have transferred eastwards and southwards within Europe.

Overall, the forecast suggests that these patterns of change will continue in the immediate future, being more evolutionary than revolutionary.

Figure 1: Past and likely future employment trends by broad sector, EU-25<sup>+</sup>

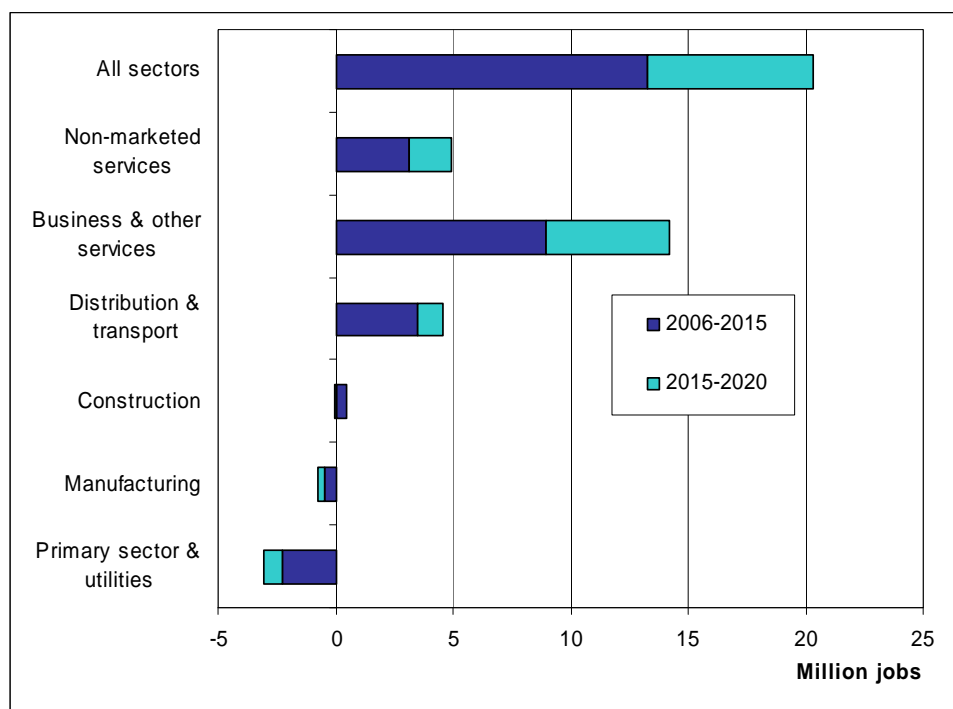


### 3.2. Around 20 million new jobs by 2020

Substantial change is in prospect. Over 20.3 million additional jobs are expected to be created between 2006 and 2020 in the EU-25<sup>+</sup> (EU-25 plus Norway and Switzerland). This is despite the loss of well over 3 million jobs in the primary sector and almost 0.8 million in manufacturing.

The construction sector has experienced positive employment trends in the past decade but tends to stagnate with less than half a million new jobs being created between 2006 and 2020. Distribution, transport, hotels and catering together are projected to see employment grow by more than 4.5 million over the next decade, while non-marketed services<sup>(3)</sup> are expected to increase by slightly more (4.9 million). Business and miscellaneous services have the best prospects, with more than 14 million additional jobs being created between 2006 and 2020 (Figure 2).

Figure 2: Employment trends by broad sector, change in millions, EU-25<sup>+</sup>

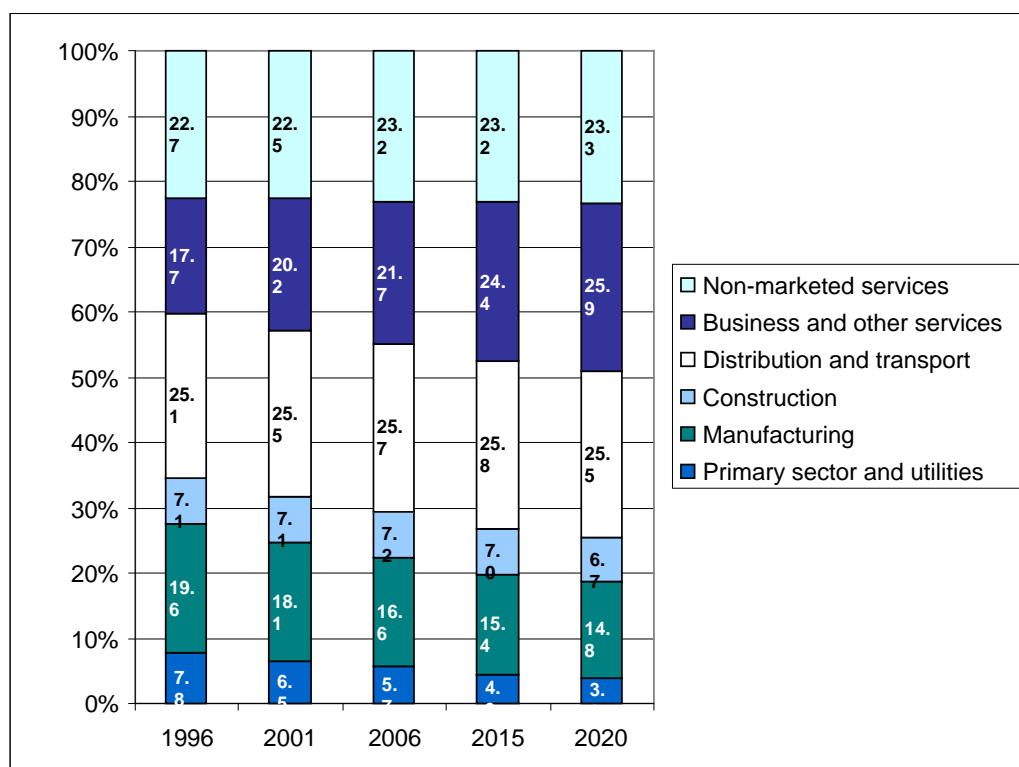


Consequently, almost three quarters of jobs in EU-25<sup>+</sup> in 2020 will be in services. The primary sector will decline from almost 8 % in 1996 to less than 4 % in 2020 (Figure 3). Manufacturing and construction are expected to experience only a slight fall in shares.

<sup>(3)</sup> A more detailed structure of broad sectors is provided in Annex C.



Figure 3: Employment trends by broad sector, shares in %, EU-25<sup>+</sup>



### 3.3. Workforce shortages in 2020

In addition to the 20.3 million new jobs created between 2006 and 2020, another 85 million jobs (four times more) will be available to replace workers who retire or leave the labour market for other reasons. The total number of job openings therefore will be 105.3 million in the EU-25<sup>+</sup> between 2006 and 2020 (Table A.4 in Annex A).

In 2020, the total number of jobs in the EU-25 will be 223.6 million (Table B.1 in Annex B). Based on demographic developments, the Eurostat baseline scenario estimates that the working age population (15-64 years) for the EU-25 will decline from 308.6 million in 2006 to 302.5 million in 2020<sup>(4)</sup>. Although the working age population will fall by around 6 million between 2006 and 2020 more than 20 million more new jobs will be created. Consequently, Europe may experience a major workforce shortage in the status quo policy scenario.

These figures imply that Europe will need an employment rate of almost 74 % to satisfy labour market demand. The current Lisbon strategy target is 70 %. If Europe meets this target by 2020, there will be a shortage of almost 12 million people in the workforce, due to the different occupational structures and potential skill gaps.

<sup>(4)</sup> Eurostat online database, Population projection, baseline variant – 1 January population by sex and single year of age (15-64) for EU-25, 2020, date of extraction: 7 June 2008.

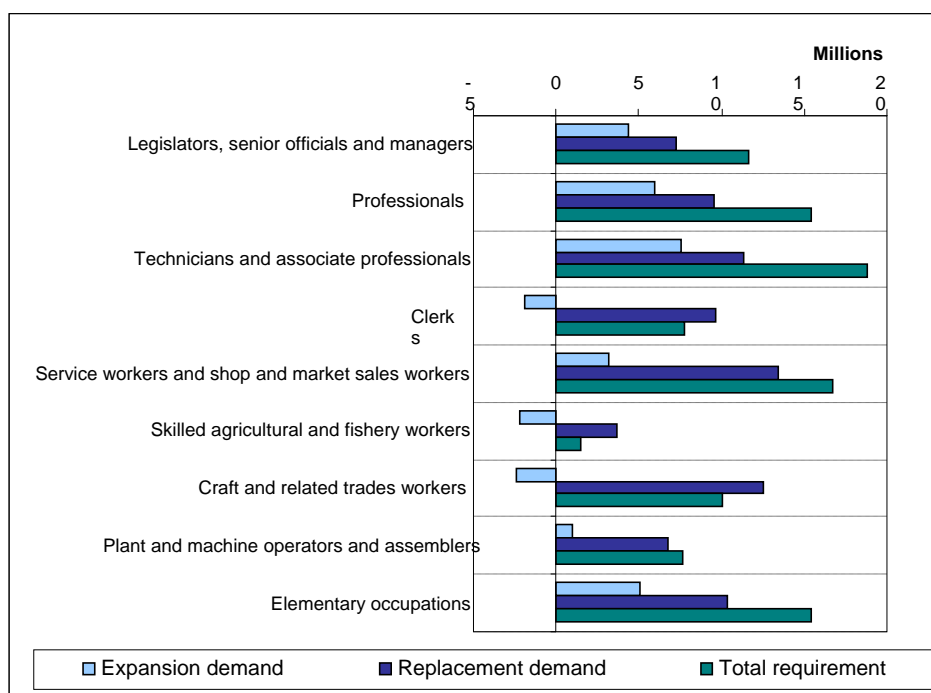
### 3.4. High- and medium-skilled occupations on the rise

Projected sectoral changes will have significant implications for the occupational skills needed in the future. These will be reinforced by changes in how work is organised and jobs are performed within sectors.

Currently, almost 40 % of people are employed in higher-level jobs such as management, professional work, or technical jobs. Expansion of high- and medium-level skilled occupations is expected to continue over the next decade. The demand for high- and medium-level skilled workers is also likely to grow, as the analysis of future skills requirements shows.

An increase is also projected for some jobs requiring no or lower levels of skills such as elementary occupations. In contrast, there will be fewer jobs for agricultural skilled workers, clerks and craft and related trades workers (Figure 4).

Figure 4: Demand by occupation, broad groups, projected change 2006-20 in millions, EU-25<sup>+</sup>



Even where employment is expected to fall, replacement demand estimates by occupation clearly indicate a significant number of job openings and demand for adequately trained people.

In all occupational categories where job losses are projected, these losses are more than offset by the estimated need to replace workers leaving the labour market (Figure 4). This means that there will be significant numbers of job openings even in the primary and manufacturing sectors. It is important that policy-makers, education and training providers, guidance services and citizens are aware that many of those occupations will remain crucial components of the economy and viable sources of jobs. What also needs considering is that the nature of these jobs and their skill requirements will change.

### 3.5. Polarisation of jobs as high and low-level occupations increase

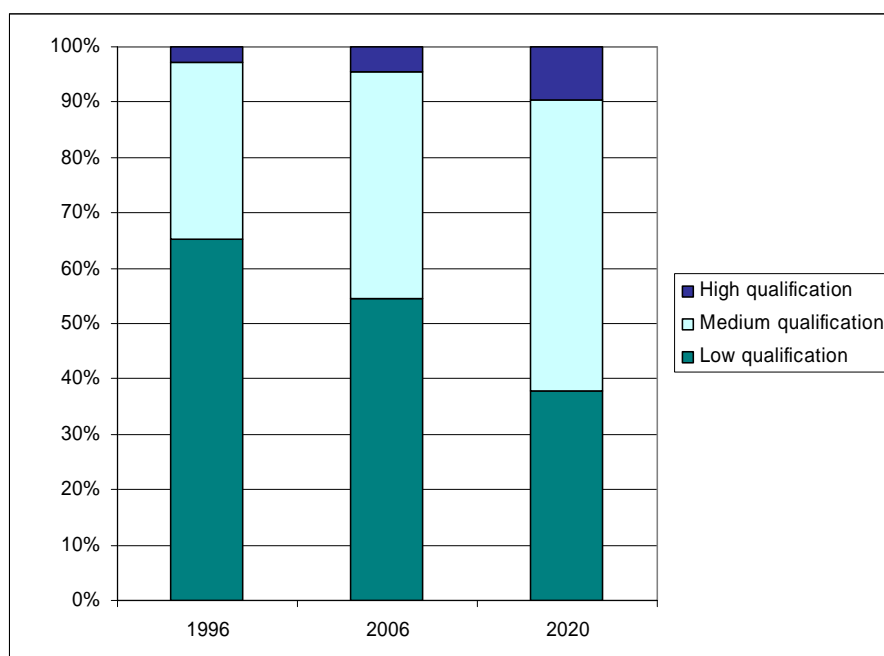
If trends continue, changes will lead to job growth at the higher-level and lower-level (with low pay and poor terms and conditions) of the job spectrum. This polarises in the demand for jobs with the medium-level occupational layer becoming thinner.

At the same time qualification requirements are increasing in all occupational categories – including those at the lowest rung of the skill-occupation ladder. This ‘upskilling’ trend may be influenced by the skill supply. Overall educational attainment rates have increased in recent years, not least as compulsory schooling has expanded in many countries and older age cohorts retire from the labour market.

Skill supply as an important push factor on the demand side of the labour market, however, raises concern. Are people’s skills adequately valued? Do the skills provided match those required? Are people overqualified carrying out jobs that could be done by people with lower educational attainment?

While recognising that the nature of jobs and the skills they require are changing is important, care should be taken not to overestimate the need for high skills. The forecast points to elementary jobs being increasingly occupied by workers with mainly medium qualifications (Figure 5). This relates directly to the debate on how to ensure equity and social inclusion in a European labour market where many workers are at a disadvantage, such as women returning to the labour market, migrant workers or ethnic minorities.

Figure 5: Changes in the composition of qualification levels of elementary occupations in 1996-2006 and the projection up to 2020, in %, EU-25<sup>+</sup>



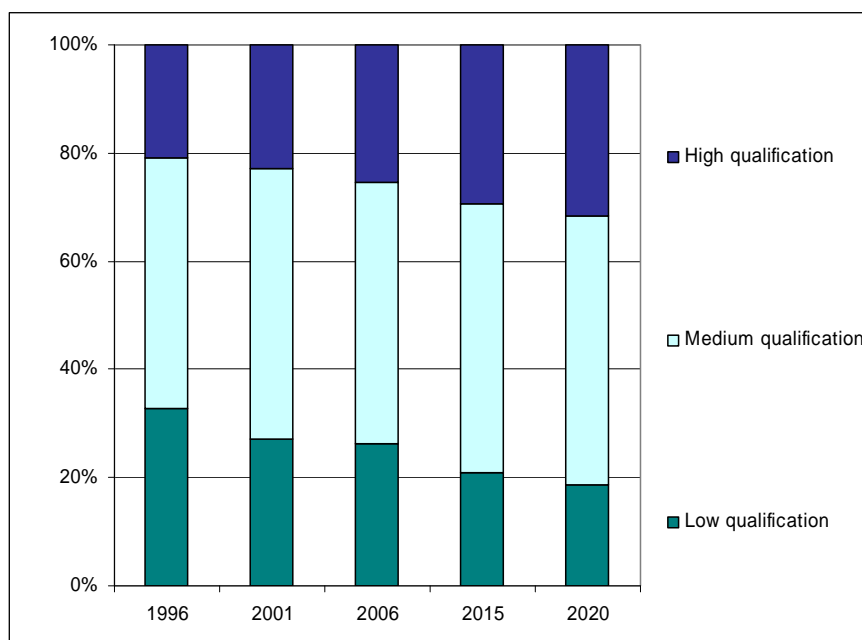
### 3.6. Increase in qualification levels

As the nature and skill requirements of these jobs will change it is important to understand how they are evolving. This includes the formal qualifications typically required to undertake such jobs.

While there is no simple one-to-one relationship between occupation and formal qualification, it is possible to explore how these are changing over time. The analysis focuses on three levels (high, medium and low qualifications). The results highlight the general increase in qualification levels across most jobs. At the broadest level the projected changes are even more dramatic for qualification levels than for occupations. In total, the net employment increase in Europe of over 20 million jobs between 2006 and 2020 comprises increases of almost 19.6 million jobs at the highest qualification level (ISCED levels 5 and 6) and almost 13.1 million jobs at medium level (ISCED levels 3 and 4). This is offset by a sharp decline of almost 12.5 million jobs for those with no or low formal qualifications (ISCED levels 0 to 2).

In part these changes reflect the recruitment behaviour of employers and the expected continued growth in supply of people with formal qualifications. In 2020, around 31.5 % of all jobs will need high qualifications, and 50 % medium qualifications. The demand for low qualifications will fall from a third in 1996 to around 18.5 % (Figure 6). While there is the possibility of oversupply in some areas, there is considerable evidence of increasing needs for, and even shortages of, people with adequate levels of qualification in many areas.

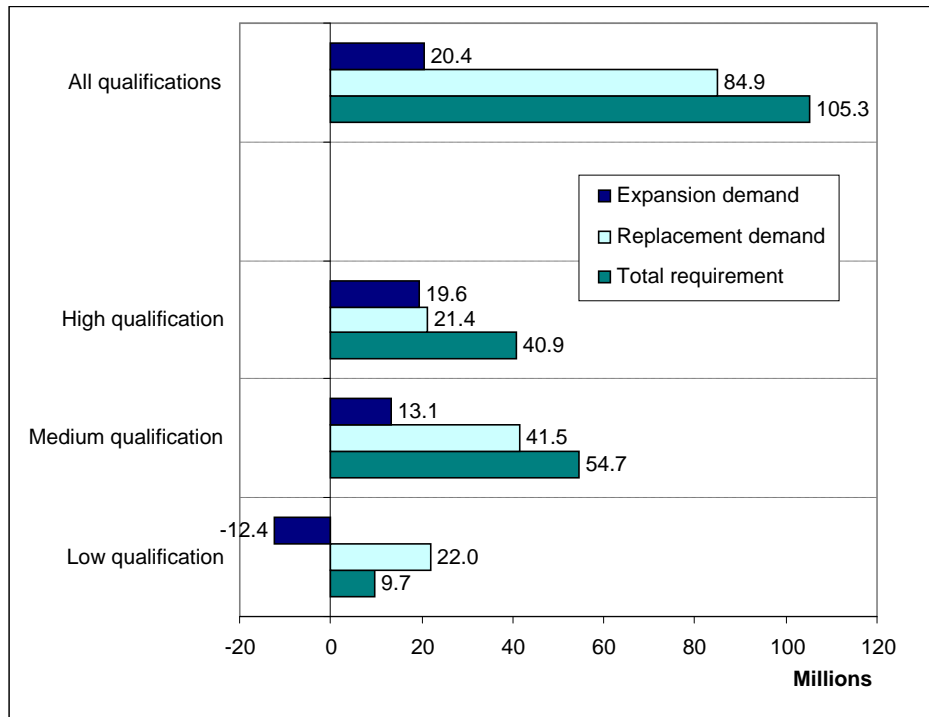
Figure 6: Past and likely future qualification structure of jobs, shares in %, EU-25<sup>+</sup>



As already pointed out, it is crucial to take replacement demand into account when determining future job opportunities, especially when assessing implications for education and training. The forecast shows that of the total 105 million job openings (the sum of expansion and replacement demand) between 2006-20 almost 41 million jobs may require

high level of qualifications (ISCED 5 and 6). The current qualification structure of the workforce needs to change in the coming decade as even more job openings, almost 55 million, are expected to require medium level qualifications (ISCED 3 and 4, which traditionally include vocational qualifications). Less than 10 million jobs will be open for applicants with no or low levels of qualifications (Figure 7).

Figure 7: Total requirement by qualification level, projected change 2006-20, in millions, EU-25<sup>+</sup>



#### 4. POLICY IMPLICATIONS

Based on these findings, overall demand for skills is likely to continue to rise. For Europe to remain competitive, policy needs to ensure that the workforce can adapt to these requirements. Europe needs a strategy to satisfy the demands of the service-oriented knowledge-intensive economy. Continuing training and lifelong learning must contribute to a process that enables people to adjust their skills constantly to on-going structural labour market change.

The young generation entering the labour market in the next decade cannot fulfil all the labour market skill needs. This has implications for education and training. Lifelong learning is paramount. It requires implementing a consistent and ambitious strategy that reduces the flow of early school leavers and drop-outs, establishes a comprehensive skills plan for adults/adult learning and which increases the supply of people trained in science and technology.

While education and training are important for improving the qualification match, they cannot fully solve problems of over- and under-education. Bottlenecks in high skill segments of the labour market may exert upward pressure on wages for these workers. At the same time, there may be a surplus of unskilled workers, which can worsen their bargaining power and, consequently, their wages and working conditions.

From a policy viewpoint, it would be very useful to have information on whether a skill mismatch is temporary or transitory (short-term labour market frictions that disappear after some time), or, whether it is a long-term phenomenon requiring targeted action.

Adequately valuing the skills of those in jobs, particularly those with lower-level formal qualifications, older workers, people with migrant background and returners to the labour market is important to avoid wasting skills and to make the best use of the skills we have. Validating and accrediting people's knowledge, skills and competences could help customise training and make it more cost-effective. Common European tools, principles and mechanisms developed in the Education and training 2010 work programme, need to be part and parcel of such packages.

It is important to recognise that training and evaluation measures alone cannot solve the problem of a major workforce shortage in Europe. Migration may be a partial answer. Given the shrinking workforce across the EU and trends in workforce demand, intra-European mobility will not suffice. Alleviating a tight labour market in one Member State at the expense of another, will not improve European economic performance overall. Attracting workers from non-EU countries as well as intra-European mobility should go hand-in-hand with measures to ensure social cohesion and equal treatment.

Labour market and other social policy measures need to be more flexible for those needing to change their job. Alongside flexicurity measures, Europe must make proposals to maximise the employment potential of its workforce. Bringing more women into the labour market and longer working lives are crucial and unavoidable measures for Europe's sustainable future.

How to balance work with personal and family lives? Reconciling the work-life balance in the context of social policy agenda and corporate social responsibility is a challenge for the coming years.

## 5. CONCLUSIONS

The results of the forecast reiterate the need to explore in more detail working conditions, skill and competence requirements and profiles of both precarious and knowledge-intensive job segments. They equally emphasise the need for policy-making to initiate measures in time to prevent, or at least alleviate, risks of skill mismatches (shortages as well as surpluses). The projected occupational change has implications for industrial, education and training, guidance and counselling, active and passive labour market measures, migration, mobility and social policies in Member States. This calls for improved governance and the cooperation of all actors, including the social partners.

The forecast brings important insights and added value to the limited knowledge about the likely future development of European labour markets. However, it also raises several questions and uncertainties about specific developments in demand for occupations and qualifications. Is demand changing in nature? Do 'elementary' occupations still correspond to their initial definition<sup>(5)</sup>? How does supply change affect demand and what could be the economic consequences of this interaction? Which specific skills and competences are needed in the future? These and other questions can only be answered if Europe invests in further research and analysis on the early identification of skill needs. Quantitative and qualitative methods of forecasting and research on the interaction between supply and demand seem crucial to understanding job polarisation and skill mismatch.

Cedefop will strengthen its research activities by improving and updating forecasts, continuing dialogue with stakeholders and its network Skillsnet, and other complementary activities. Currently, Cedefop is carrying out a forecast of future skill supply and a detailed analysis of possible mismatches between supply and demand (skill shortages and gaps, oversupply and over-qualification). Results are expected early in 2009. Cedefop will regularly update and improve data and methods of forecasting skill demand and supply, working closely with country experts. In parallel to quantitative measurement at macro level, Cedefop is exploring the feasibility and efficiency of identifying skill and competence needs at the workplace using enterprise/employers' surveys as a complementary and more qualitative source of information. In addition, Cedefop will investigate how labour market developments shape skill requirements, how participation in education and training impact the supply of skills, and to what extent European labour markets suffer from skill mismatch problems.

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<sup>(5)</sup> According to the ISCO-88 definition, elementary occupations consist of simple and routine tasks and normally require skills at the first ISCO skill level (ILO).

## ANNEX A: TABLES FOR EU-25<sup>+</sup> (EU-25, NORWAY AND SWITZERLAND)

Table A.1: Employment by broad sector, EU-25<sup>+</sup>

Levels (000s)	1996	2001	2006	2015	2020
Primary sector & utilities	15 052	13 446	11 917	9 629	8 871
Manufacturing	37 802	37 297	34 871	34 414	34 146
Construction	13 729	14 514	15 141	15 583	15 580
Distribution & transport	48 356	52 566	54 242	57 740	58 843
Business & other services	34 022	41 627	45 638	54 559	59 820
Non-marketed services	43 753	46 394	48 846	52 011	53 749
All industries	192 714	205 844	210 656	223 936	231 009

Source: Cedefop (IER, ROA, EC estimates)

Table A.2: Employment change by broad sector, EU-25<sup>+</sup>

Change (000s)	1996-2001	2001-06	2006-15	2015-20	2006-20
Primary sector & utilities	-1 606	-1 529	-2 289	-758	-3 047
Manufacturing	-505	-2 426	-457	-268	-725
Construction	785	627	442	-3	438
Distribution & transport	4 210	1 676	3 498	1 104	4 602
Business & other services	7 606	4 011	8 921	5 260	14 181
Non-marketed services	2 642	2 452	3 165	1 738	4 904
All industries	13 131	4 811	13 280	7 073	20 353

Source: Cedefop (IER, ROA, EC estimates)

Table A.3: Employment by occupation, EU-25<sup>+</sup>

Levels (000s)	1996	2001	2006	2015	2020
Armed forces	1 245	1 197	1 215	1 165	1 130
Legislators senior officials and managers	15 394	16 333	18 405	21 076	22 722
Professionals	24 220	25 482	27 349	31 111	33 275
Technicians and associate professionals	27 643	31 733	33 952	38 691	41 502
Clerks	24 632	25 088	23 317	22 044	21 436
Service workers and shop and market sales workers	25 385	28 717	29 490	32 017	32 702
Skilled agricultural and fishery workers	9 829	8 960	7 789	6 082	5 549
Craft and related trades workers	30 641	29 893	28 845	27 420	26 385
Plant and machine operators and assemblers	17 069	17 304	17 314	17 850	18 260
Elementary occupations	16 655	21 137	22 980	26 480	28 046
All occupations	192 713	205 844	210 656	223 936	231 009

Source: Cedefop (IER, ROA, EC estimates)



Table A.4: Demand by occupation 2006-20 EU-25<sup>+</sup>

<b>2006-2020</b>	<b>Expansion demand</b>	<b>Replacement demand</b>	<b>Total job openings</b>
Armed forces	-85	490	405
Legislators senior officials and managers	4 317	7 276	11 593
Professionals	5 926	9 497	15 423
Technicians and associate professionals	7 550	11 301	18 851
Clerks	-1 880	9 611	7 731
Service workers and shop and market sales workers	3 212	13 464	16 676
Skilled agricultural and fishery workers	-2 240	3 689	1 449
Craft and related trades workers	-2 460	12 519	10 059
Plant and machine operators and assemblers	945	6 714	7 659
Elementary occupations	5 067	10 357	15 424
All occupations	20 353	84 919	105 272

Source: Cedefop (IER, ROA, EC estimates)

Table A.5: Employment by qualification, EU-25<sup>+</sup>

<b>Levels (000s)</b>	<b>1996</b>	<b>2001</b>	<b>2006</b>	<b>2015</b>	<b>2020</b>
Low qualification	63 339	55 671	55 104	46 516	42 751
Medium qualification	89 127	102 799	102 291	111 752	115 423
High qualification	40 248	47 374	53 261	65 668	72 835
All qualifications	192 714	205 844	210 656	223 936	231 009

Source: Cedefop (IER, ROA, EC estimates)

Table A.6: Demand by qualification, 2006-20 EU-25<sup>+</sup>

<b>2006-2020</b>	<b>Expansion demand</b>	<b>Replacement demand</b>	<b>Total job openings</b>
Low qualification	-12 353	22 014	9 661
Medium qualification	13 132	41 542	54 674
High qualification	19 574	21 363	40 937
All qualifications	20 353	84 919	105 272

Source: Cedefop (IER, ROA, EC estimates)

Table A.7: Employment shares by qualification, EU-25<sup>+</sup>

<b>Shares (%)</b>	<b>1996</b>	<b>2001</b>	<b>2006</b>	<b>2015</b>	<b>2020</b>
Low qualification	32.9	27.0	26.2	20.8	18.5
Medium qualification	46.2	49.9	48.6	49.9	50.0
High qualification	20.9	23.0	25.3	29.3	31.5
All qualifications	100.0	100.0	100.0	100.0	100.0

Source: Cedefop (IER, ROA, EC estimates)

Table A.8: Employment change by qualification, EU-25<sup>+</sup>

<b>Change (000s)</b>	<b>1996-2001</b>	<b>2001-06</b>	<b>2006-15</b>	<b>2015-20</b>	<b>2006-20</b>
Low qualification	-7 667	-567	-8 588	-3 765	-12 353
Medium qualification	13 672	-508	9 461	3 671	13 132
High qualification	7 126	5 887	12 408	7 167	19 574
All qualifications	13 131	4 811	13 280	7 073	20 353

Source: Cedefop (IER, ROA, EC estimates)

## ANNEX B: TABLES FOR EU-25

*Table B.1: Employment by broad sector EU-25*

<b>Levels (000s)</b>	<b>1996</b>	<b>2001</b>	<b>2006</b>	<b>2015</b>	<b>2020</b>
Primary sector & utilities	14 692	13 104	11 619	9 410	8 674
Manufacturing	36 755	36 273	33 931	33 431	33 124
Construction	13 295	14 085	14 691	15 131	15 137
Distribution & transport	46 635	50 818	52 467	55 961	57 058
Business & other services	32 962	40 343	44 220	52 753	57 799
Non-marketed services	42 265	44 757	47 078	50 145	51 838
All industries	186 604	199 379	204 005	216 832	223 631

Source: Cedefop (IER, ROA, EC estimates)

*Table B.2: Employment change by broad sector EU-25*

<b>Change (000s)</b>	<b>1996-2001</b>	<b>2001-06</b>	<b>2006-15</b>	<b>2015-20</b>	<b>2006-20</b>
Primary sector & utilities	-1 588	-1 485	-2 209	-736	-2 945
Manufacturing	-482	-2 342	-499	-308	-807
Construction	790	606	441	6	447
Distribution & transport	4 183	1 649	3 494	1 097	4 591
Business & other services	7 381	3 878	8 533	5 046	13 579
Non-marketed services	2 493	2 320	3 068	1 693	4 761
All industries	12 775	4 626	12 828	6 798	19 626

Source: Cedefop (IER, ROA, EC estimates)

*Table B.3: Employment by occupation EU-25*

<b>Levels (000s)</b>	<b>1996</b>	<b>2001</b>	<b>2006</b>	<b>2015</b>	<b>2020</b>
Armed forces	1 232	1 182	1 200	1 153	1 121
Legislators senior officials and managers	14 962	15 926	17 973	20 622	22 218
Professionals	23 501	24 580	26 360	29 838	31 835
Technicians and associate professionals	26 421	30 366	32 549	37 094	39 800
Clerks	23 829	24 310	22 574	21 376	20 803
Service workers and shop and market sales workers	24 400	27 641	28 301	30 720	31 366
Skilled agricultural and fishery workers	9 527	8 691	7 565	5 931	5 412
Craft and related trades workers	29 704	28 994	27 952	26 542	25 544
Plant and machine operators and assemblers	16 708	16 912	16 921	17 436	17 830
Elementary occupations	16 321	20 777	22 608	26 121	27 700
All occupations	186 604	199 379	204 005	216 832	223 631

Source: Cedefop (IER, ROA, EC estimates)

Table B.4: Demand by occupation 2006-2020 EU-25

<b>2006-2020</b>	<b>Expansion demand</b>	<b>Replacement demand</b>	<b>Total job openings</b>
Armed forces	-79	481	402
Legislators senior officials and managers	4 245	6 992	11 237
Professionals	5 475	8 799	14 274
Technicians and associate professionals	7 251	10 443	17 694
Clerks	-1 771	9 055	7 284
Service workers and shop and market sales workers	3 066	12 677	15 743
Skilled agricultural and fishery workers	-2 153	3 529	1 376
Craft and related trades workers	-2 408	11 901	9 493
Plant and machine operators and assemblers	909	6 468	7 377
Elementary occupations	5 092	10 091	15 183
All occupations	19 626	80 435	100 061

Source: Cedefop (IER, ROA, EC estimates)

Table B.5: Employment by qualification EU-25

<b>Levels (000s)</b>	<b>1996</b>	<b>2001</b>	<b>2006</b>	<b>2015</b>	<b>2020</b>
Low qualification	62 249	54 746	54 145	45 481	41 652
Medium qualification	85 522	99 040	98 567	108 190	111 934
High qualification	38 833	45 594	51 293	63 162	70 044
All qualifications	186 604	199 379	204 005	216 832	223 631

Source: Cedefop (IER, ROA, EC estimates)

Table B.6: Demand by qualification 2006-2020 EU-25

<b>2006-2020</b>	<b>Expansion demand</b>	<b>Replacement demand</b>	<b>Total job openings</b>
Low qualification	-12 492	21 335	8 843
Medium qualification	13 367	39 038	52 405
High qualification	18 751	20 062	38 813
All qualifications	19 626	80 435	100 061

Source: Cedefop (IER, ROA, EC estimates)

Table B.7: Employment shares by qualification EU-25

<b>Shares (%)</b>	<b>1996</b>	<b>2001</b>	<b>2006</b>	<b>2015</b>	<b>2020</b>
Low qualification	33.4	27.5	26.5	21.0	18.6
Medium qualification	45.8	49.7	48.3	49.9	50.1
High qualification	20.8	22.9	25.1	29.1	31.3
All qualifications	100.0	100.0	100.0	100.0	100.0

Source: Cedefop (IER, ROA, EC estimates)

Table B.8: Employment change by qualification EU-25

<b>Change (000s)</b>	<b>1996-2001</b>	<b>2001-06</b>	<b>2006-15</b>	<b>2015-20</b>	<b>2006-20</b>
Low qualification	-7 503	-601	-8 664	-3 828	-12 492
Medium qualification	13 518	-473	9 623	3 744	13 367
High qualification	6 760	5 699	11 869	6 882	18 751
All qualifications	12 775	4 626	12 828	6 798	19 626

Source: Cedefop (IER, ROA, EC estimates)

## ANNEX C: CLASSIFICATIONS AND AGGREGATIONS USED

### Sectors

#### 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]

## Qualifications

LEVEL OF QUALIFICATION	
Low	At most lower secondary (ISCED 0-2)
Medium	Upper secondary (ISCED 3-4)
High	Tertiary (ISCED 5-6)

### *ISCED 0: pre-primary education*

Programmes at level 0, (pre-primary) defined as the initial stages 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 level 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 level 2 and often teachers need to be more qualified or specialised than for ISCED level 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 level 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 level 3A or 3B or a similar qualification at ISCED level 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 EULFS: Levels of education and training ISCED 1997 ([http://circa.europa.eu/irc/dsis/employment/info/data/eu\\_lfs/Related\\_documents/ISCED\\_EN.htm](http://circa.europa.eu/irc/dsis/employment/info/data/eu_lfs/Related_documents/ISCED_EN.htm))

## Occupations

<b>ISCO</b>	
<b>MAJOR GROUP 1: LEGISLATORS, SENIOR OFFICIALS AND MANAGERS</b>	
11	Legislators and senior officials
12	Corporate managers
13	Managers of small enterprises
<b>MAJOR GROUP 2: PROFESSIONALS</b>	
21	Physical, mathematical and engineering science professionals
22	Life science and health professionals
23	Teaching professionals
24	Other professionals
<b>MAJOR GROUP 3: TECHNICIANS AND ASSOCIATE PROFESSIONALS</b>	
31	Physical and engineering science associate professionals
32	Life science and health associate professionals
33	Teaching associate professionals
34	Other associate professionals
<b>MAJOR GROUP 3: CLERKS</b>	
41	Office clerks
42	Customer services clerks
<b>MAJOR GROUP 4: SERVICE WORKERS AND SHOP AND MARKET SALES WORKERS</b>	
51	Personal and protective services workers
52	Models, salespersons and demonstrators
<b>MAJOR GROUP 6: SKILLED AGRICULTURAL AND FISHERY WORKERS</b>	
61	Skilled agricultural and fishery workers
<b>MAJOR GROUP 7: CRAFT AND RELATED TRADES WORKERS</b>	
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
<b>MAJOR GROUP 8: PLANT AND MACHINE OPERATORS AND ASSEMBLERS</b>	
81	Stationary plant and related operators
82	Machine operators and assemblers
83	Drivers and mobile plant operators
<b>MAJOR GROUP 9: ELEMENTARY OCCUPATIONS</b>	
91	Sales and services elementary occupations
92	Agricultural, fishery and related labourers
93	Labourers in mining, construction, manufacturing and transport
<b>MAJOR GROUP 0: ARMED FORCES</b>	



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