CHARLES UNIVERSITY IN PRAGUE
FACULTY OF EDUCATION
EDUCATION POLICY CENTRE

Occupational Skills Profiles: Methodology and application

Contribution to the concept, structure, and quantification of skill needs in Europe

In part delivery of Framework Agreement on Forecasting skill supply and demand in Europe (in response to open invitation to tender No AO/RPA/AZU-TODUN/European-skills-forecasts/009/08).
Task 11

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Preface and Acknowledgements

This report summarises some results from the Cedefop *Skillsnet* project on *Forecasting skill supply and demand in Europe* undertaken as part of the new *Framework Agreement* which extends over the 4 years 2008/09-2012/13.

These results from the project generally represent the result of a team effort, and reflect the contributions of all those working on it, including: Ilias Livanos and Derek Bosworth from IER; Terry Ward and Robert Stehrer from Alphametrics; Anthony Barker, Hector Pollitt, Unnada Chewpreecha and Jennifer Barton from CE; and Ben Kriechel and Jan Suerman from ROA. These all form part of the Core team responsible for producing the projections. In addition important contributions were made by the Country Group Experts (Pekka Tiainen, Catalin Ghinaru, Tim Grebe, Matthias Kirbach, Simonas Gausas, Haroldas Brozaitis). Jan Koucký and Martin Lepič also contributed to the review of sectoral studies and were responsible for the development of the methodology for Occupational Skills Profiles.

Thanks are also due to the various experts from individual countries who have taken time to review and comment upon the emerging findings

Rob Wilson (Project team leader)

This third expanded version of "***Occupational Skills Profiles: Methodology and application***" (EPC, December 2011) reflects comments and questions we have received personally or in correspondence during the last months. It was really a great help for us.

However we are aware that a lot of work still has to be done, also because all analyses have not been finished yet, and new ESS and BLS data will be coming till February 2012. We are planning therefore to publish the final version of the Methodology in the first half of 2012.

We would like very much to use another round of comments for preparing it. Therefore we will be grateful for any comments, suggestions or recommendations we will have received before March 2012.

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1. Concept of Occupational Skills Profiles

1.1 Definition

Since 2007 the Education Policy Centre (at the Faculty of Education, Charles University in Prague – EPC) have been developing a new concept of qualification profiles as a comprehensive and standardised way how to describe requirements of a specific occupation (or occupational group, sector, and even a whole economy) concerning education, qualification and personal qualities of prospective job holders. When applied to this project *Forecasting of skill supply and demand in Europe to 2020* – as a part delivery of the Task *Implications for generic skills and disciplines* – the new concept is referred to as occupational skills profiles.

An *occupational skills profile* summarises essential characteristics required for a given job: the level of education and training required (and hence the complexity of the occupation); the field of education and training required; main and supplementary requirements concerning knowledge, skills, personal abilities, attitudes and values.

The more detailed contents of occupational skills profiles structured in seven dimensions and the way how they have been quantified are described in Chapter 2, as well as their relationship to the core projections produced in the main project. The way, how they have been generated, is described in the Annex.

Occupational skills profiles of specific occupations can be aggregated into occupational skills profiles of occupational groups, further into occupational skills profiles of sectors, then into occupational skills profiles of national economies, and finally up to Pan-European level.

Occupational skills profiles have been developed for analysing, projecting and forecasting skill needs, for determining and measuring education/skills matches and mismatches in different countries, sectors or occupations, and for comparing and monitoring differences between European countries as well as for determining change over time, identifying past and future developments. Their application, however, is far wider. They can be also used for preparing educational and training programmes, both school and enterprise based, for the choice of a concrete job or of the best way how to prepare for it. They can be used by all main labour market partners, as decision makers, employers, educational institutions and individual students and workers.

In order to be able to serve their purpose, occupational skills profiles have to meet simultaneously certain specific requirements, which makes them quite unique:

- they are defined at such a level of occupational classification that allows identification of distinct, occupation-specific features adequately, while at the same time they can be transposed both to other classification levels and to other classification systems as necessary;
- their characteristics are not only quantifiable and measurable, but they are regularly measured, that is they are supported by available statistics and data sets, allowing the creation of time series and identification of changes over time;

- they are consistent as far as possible with concepts, classifications, and instruments used in Europe, in particular with the European Qualification Framework.

As all the requirements have to be met at the same time, many problems have to be dealt with. These include, in particular, problems how to define the appropriate level of classification, how to find usable and fitting data, how to transpose safely from one level and/or system of classification to another, and how to achieve reasonable consistency between data and frameworks coming from different sources.

1.2 Appropriate level of classification and availability of data

An occupational skills profile of a specific individual occupation (sometimes the term occupational unit is used) sums up characteristics of all similar jobs, classified under the given occupation. At higher levels of classification, individual occupations can be aggregated into corresponding occupational groups, thus representing all occupations with a certain degree of similarity reflecting the classification principle employed.

An occupational skills profile makes sense only on condition that the respective occupational unit is not too broad, or in other words, it is still possible to take it as an individual occupation. Otherwise it would be by necessity contaminated by other occupations, and the resulting qualification requirements would come closer to the average – the higher the level of aggregation, the more distorted the outcome. Hence occupational skills profiles should be determined at the lowest level possible, the one that is still covered by statistics and can be handled in a comparable way across Europe. In other words, occupational skills profiles have to be elaborated at the level where the job structure and job characteristics are sufficiently detailed and specific as to identify important differences between groups of jobs and make them sufficiently visible, and at the same time when they are supported by empirical data. *Both aspects are paramount – the choice of the most suitable level of classification, and the availability of empirical data at European level.* This proposition is central to the EPC approach.

When choosing the level of the most suitable classification of occupations by their contents, requirements and complexity, we have to take into account the varying relationship between a job, an occupation and an occupational group at different levels of aggregation (see BOX 1).

BOX 1 Job/Occupation

A *job* (a work place) represents a basic unit covering a certain set of work activities performed by one person. Strictly taken, each job has a specific, slightly different occupational skills profile. Nevertheless, there exist jobs with very similar occupational skills profiles and negligible differences. Those jobs then make up individual occupation.

An *occupation* (sometimes another term is used – a profession) is then defined as a group of jobs with sufficiently similar characteristics to have one occupational skills profile. Classifications of occupations are thus a means for grouping occupations by their similarity. Definitions of occupations vary in different countries, also classification systems are different.

For example, in the *USA* there are about 150 million of jobs in the labour market, described by 12 thousand of occupational titles and clustered into about one thousand individual occupations classified by the US Standard Occupation Classification System (SOC); their exact number is changing all over the time. Individual occupations are further clustered at several levels into still broader occupational

groups. The number of jobs and employed in all individual occupations classified by the SOC is monitored by the Occupational Employment Statistics (OES). The *Italian* classification of occupations, developed recently as a part of the project *Indagine sulle professioni*, contains over 800 basic occupations. However, it is quite difficult to link this classification with corresponding data concerning the development of the number of jobs in individual occupations at the Italian labour market. The *Czech* Classification of Occupations (KZAM) was established in 1991 by adopting almost without a change all four levels of the international classification ISCO 1988, with about 500 groups of occupation, and by extending it by the fifth more detailed national level consisting of about 3500 individual occupations. This detailed classification cannot be, however, linked to standard statistics, for example to the Labour Force Survey.

A decisive role is played by the classification system employed. The Eurostat database on occupations – as well as most comparisons of occupational structures between European countries – is based on the International Standard Classification of Occupations (ISCO), both the best and the only one today (see BOX 2). As the ISCO-88 is still used by the Eurostat, and all available data have been based on it since the beginning of the 90s, the EPC have used it for the construction of occupational skills profiles.

Nevertheless, they are aware of certain weaknesses of this system of classification. First, it is limited to the 4-digit level with only about 500 occupational groups (while some other systems contain about twice as much). Second – and perhaps most importantly – only about a third of European countries provides data at this level. Data for most European countries are available only at the ISCO 3-digit level which defines rather broad occupational groups. It is not surprising therefore that their occupational skills profiles are not clear-cut, as they include some quite similar but at the same time also some quite different occupations.

BOX 2 ISCO

The *International Standard Classification of Occupations 1988* (ISCO-88) is a good example of the way how to design and construct a classification. It has been based on two main concepts: the concept of the kind of work performed or *job*, and the concept of *skill*.

Job – defined as a set of tasks and duties executed, or meant to be executed, by one person – is the *statistical unit* classified by ISCO-88. A set of jobs whose main tasks and duties are characterised by a high degree of similarity constitutes an *occupation*. Persons are classified by occupation through their relationship to a past, present or future job.

Skill – defined as the ability to carry out the tasks and duties of a given job – has, for the purposes of ISCO-88 the two following dimensions:

(a) *Skill level* – which is a function of the complexity and range of the tasks and duties involved; and

(b) *Skill specialisation* – defined by the field of knowledge required, the tools and machinery used, the materials worked on or with, as well as the kinds of goods and services produced.

On the basis of the skill concept thus defined, ISCO-88 occupational groups were delineated and further aggregated at four levels:

1st ISCO level – major groups with 10 occupation group titles,
2nd ISCO level – sub-major groups with 27 occupation group titles,
3rd ISCO level – minor groups with about 110 occupation group titles,
4th ISCO level – unit groups with about 500 occupation group titles.

Jobs are characterized not only by occupation (profession), but also by sector (sometimes another term is used – an industry) as their another essential dimension. The Eurostat database uses the NACE classification (see BOX 3).

BOX 3 NACE

The *Statistical Classification of Economic Activities* in the European Community (NACE) Rev. 1.1 is the classification of economic activities corresponding to ISIC Rev.3 at European level. Though more disaggregated than ISIC Rev.3.1, NACE Rev.1.1 is entirely in line with it and can thus be regarded as its European counterpart. Since the national economic structures vary considerably, there are branches of industry in NACE Rev. 1.1 which are not of importance or do not occur in all Member States (e.g. branches of mining and quarrying, manufacture of spacecraft, etc.). The NACE Rev. 1.1 Regulation allows the Member States to use a national version derived from NACE Rev. 1.1 for national purposes. Such national versions must, however, fit into the structural and hierarchical framework laid down by NACE Rev. 1.1.

NACE Rev 1.1 is structured at four levels:
Level 1: 17 sections identified by alphabetical letters A to Q;
(an intermediate level: 31 sub-sections identified by two-character alphabetical codes);
Level 2: 62 divisions identified by two-digit numerical codes (01 to 99);
Level 3: 224 groups identified by three-digit numerical codes (01.1 to 99.0);
Level 4: 514 classes identified by four-digit numerical codes (01.11 to 99.00).

In the project the Cambridge Econometrics use the E3ME model whose structure of sectors is based on classification NACE Rev.1.1, and the number of sectors has been reduced by different aggregations to 41. The EPC use the same classification, however the number of sector has been further reduced to 38, as three pairs of sectors had to be united due to data limitations. The first united sector puts together sectors Pharmaceuticals (10) and Chemicals (11), the second one sectors Electricity (22) and Gas Supply (23), and the third one sectors Professional Services (36) and Other Business Services (37).

1.3 Finding fitting sources

Should they be utilised for the construction of occupational skills profiles, data sources have to meet certain stringent stipulations. First, occupations must be defined on the basis of the ISCO classification or on the basis of a classification convertible to the ISCO. Second, they have to cover the bulk of the labour market. Third, they have to be structured both by sector and by occupation.

In order to find the way how not only to define but also to quantify occupational skills profiles, the EPC had to examine and analyse more than twenty of the most important surveys in Europe (and outside of it, especially in the USA) concerning level of qualification and other work requirements. The EPC have found that many surveys have no or only a very limited use, and only few surveys have passed a very exacting (and time-consuming) selection process consisting of four steps:

1. Firstly, all available documents and other information concerning the survey in question have been thoroughly studied in order to find all necessary characteristics: what is its main focus and scope, how it is conducted, whether it is periodical and at what interval it is repeated, and how the information gathered generally fits into our theoretical and

methodological concept. Only if the result of the first step has been positive, the second step has followed.

2. The second step has focused on the very usability of data: how they would enlarge the empirical database of our project, whether and to what degree they can be mapped into a common European database, particularly what level of classification is used and whether it can be transposed to required levels of classifications used by the Eurostat – the industry classification NACE and the occupational classification ISCO (national classifications often cause problems). Again, only if results have been positive, the next step has followed.
3. In the third step communication with experts of the country in question (or directly of the institution conducting the survey) has been established. Its objective has been to find out whether and under what conditions it is possible to obtain their data (sometimes they have been paid for) and also whether it is possible that those who had carried out the survey could assist us in solving problems mentioned in previous steps. Again, only if our negotiations have resulted in gaining access to the data, sometimes with some advice and recommendations, it has been possible to proceed to the final step.
4. The final step consisted in thorough analyses of data obtained, of statistical behaviour of variables and of their role in the overall concept, of transforming national classifications to Eurostat classifications, and of including new data to the final empirical model. Also in this step the survey in question could have been abandoned when its previous positive assessments have proved to be too optimistic.

For instance, in many respects quite promising large and periodical German surveys (*Erwerbstätigenbefragung. BIBB-IAB-BAuA*, 1978-2006, 2012) with about twenty thousand respondents can be used only partly as their time series is not quite consistent (in subsequent rounds some questions were not formulated in the same way and different options were offered) and only some characteristics (and some occupations, too) are comparable and can be used. Yet the EPC has tried to use the German survey as much as it has been possible.

The *British Skills Survey* (periodically conducted since the mid-eighties) is beset with even more problems: the very transposition of the British classification SOC to the international classification ISCO is problematic, its consistency and hence comparability in time is not clear, the survey comprising only about six thousand respondents is not sufficiently robust for the ISCO 3-digit level.

When the selection process described above has been completed, out of all surveys analysed only the following six surveys have met all conditions and prerequisites (that have been far from trivial), and have been included into the common European model serving for the construction of OSPs:

- *European Social Survey ESS (International)*
- *O*NET (USA)*
- *US BLS Education and Training Requirements Categories (USA)*
- *BIBB/BAuA Erwerbstätigenbefragung (Germany)*
- *Indagine sulle professioni (Italy)*
- *Kvalifikace (Czech Republic)*

European Social Survey ESS

Particularly, the *European Social Survey* (ESS) has been a very important source utilised for defining the first two dimensions, the level and the field of education.

The European Social Survey (ESS) is a research programme of the European Science Foundation focused particularly on value orientation and the social structure of current European societies. Although the ESS is not primarily focused on an analysis of the skill needs in relation to jobs and on the qualifications of employees, it contains questions that may be very helpful in this respect. Its major advantage is its continuing nature and opportunity to obtain data for relatively extensive samples of adult population within a wide age span in nearly thirty European countries. The ESS surveys take place every two years and five rounds have been implemented so far: the ESS-1 in 2002/2003, the ESS-2 in 2004/2005, the ESS-3 in 2006/2007, the ESS-4 in 2008/2009 and the ESS-5 in 2010/2011. Their data set contains almost 180 thousands respondents in 30 countries.

In terms of the identification of skill needs the most interesting stages were the ESS-2 and ESS-5, as both contain an additional special module, focused on education, qualification, work and employment.

The set of data from the ESS-2 developed and analysed for the purpose of this study covers nearly 50 thousand respondents from 22 European countries (Austria, Belgium, the Czech Republic, Denmark, Finland, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom).

In this study also preliminary ESS-5 data (available since the beginning of November 2011) have been used. They cover about 40 thousand respondents from 19 European countries (Belgium, Bulgaria, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, the Netherlands, Norway, Poland, Portugal, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom). The remaining European countries included in ESS-5 (f.i. Austria, Greece, Ireland, Italy, Slovakia) should be available in March 2012. The outcome of processing and analyzing all final ESS-5 data will be included into the final version of the methodological study in 2012.

The characteristics of the employed respondents also included identification of the sector where they work in line with the 2-digit NACE/ISIC, and identification of the occupation performed according to the 4-digit ISCO, as well as the level of educational attainment (in most countries it is possible to define 6-8 comparable levels of education; some countries do not have all the levels), and the field of education (ESS surveys distinguish 14 fields of education & training defined on the basis of the ISCED classification).

In 2010, however, a new classification was prepared which amalgamated existing distinct systems and defined new common educational levels. It was very carefully constructed in a close contact with experts of individual countries. The new classification, applied in the ESS-5 as well as in all previous surveys forming the ESS database, has defined the following educational levels in European countries:

ES-ISCED I, less than lower secondary

ES-ISCED II, lower secondary

ES-ISCED IIIb, lower tier upper secondary

ES-ISCED IIIa, upper tier upper secondary

ES-ISCED IV, advanced vocational, sub-degree

ES-ISCED V1, lower tertiary education, BA level

ES-ISCED V2, higher tertiary education, >= MA level

However, some countries are still missing, outside the new classification, and the ISCED level VI has not been included at all. Therefore, the ECP is trying to construct the highest level (ES-ISCED VI) of the classification and also to find its best proxy for countries outside it. Then we will use the new classification in our further work.

O*NET

Analyses of various available sources have shown that the most suitable source of information about qualification and other work requirements is to be found in the US *Occupational Information Network (O*NET)*. What is also significant is the fact that since the year 2000 (and especially since the year 2005) characteristics of about 750 individual occupations have remained quite stable and that they have been regularly updated. Thus it is possible to monitor and analyse their development and change.

The Occupational Information Network (O*NET) is a comprehensive on-line system for collecting, organising and disseminating occupational data. It was launched in 1998 by the US Department of Labor, replacing the Dictionary of Occupational Titles (D.O.T.), developed more than fifty years ago and existing up to mid-nineties in a printed form. O*NET data inform important activities in workforce development, economic development, career development, academic and policy research, and human resource management.

Target Date	Database Version
April 2003	5.0
July 2004	6.0
December 2004	7.0
June 2005	8.0
December 2005	9.0
June [illegible]	10.0
[illegible]	11.0
June [illegible]	12.0
June [illegible]	13.0
June [illegible]	14.0
June [illegible]	15.0
February [illegible]	15.1
July [illegible]	16.0

A new version of the O*NET database is published annually in late June (exceptionally, it can also be published in another term). After some structural changes and the introduction of the version 5.0 in April 2005, data have been consistent. Every year approximately 100-120 occupations are updated. The O*NET 16.0 database, published in July 2011, represents the most recent update of the data collection program.

The two O*NET core elements are a content model and an electronic database fed by a data collecting program.

The content model provides a framework for more than 400 variables describing about 1100 occupations based on the SOC. The descriptors are organised into six major domains, which enable the user to focus on areas of information that specify the key attributes and characteristics of workers (the first three domains) and of jobs (the last three domains), and are either cross-occupational or occupation-specific:

Worker Characteristics, comprising enduring characteristics that may influence both work performance and the capacity to acquire knowledge and skills, such as abilities, occupational interests, work values and work styles;

Worker Requirements, representing attributes developed and/or acquired through experience and education, such as work-related knowledge and skills, which are divided into basic skills and cross-functional skills;

Experience Requirements, including information about the typical experiential background of workers including certification, licensure, and training data;

Occupational Requirements, describing typical activities required across occupations, as generalized and detailed work activities occurring on multiple jobs, plus contextual variables (factors physical, social and organizational);

Labour Market Characteristics, linking descriptive occupational information to statistical market information (including compensation and wage data, employment outlook and industry size information);

Occupation-Specific Information, applying to a single occupation or a narrowly defined job family.

Although the O*NET has been used as a prime source for almost all characteristics, they have been also derived from other sources whenever possible. Among them two European surveys on occupation have closely followed the O*NET approach – the Italian survey *Indagine sulle professioni* and the Czech survey *Kvalifikace2008*.

US BLS Education and Training Requirements Categories

The Occupational Outlook Handbook, produced by the Office of Occupational Statistics and Employment Projections of the Bureau of Labor Statistics (BLS), gives detailed descriptions of the education and training requirements of about 750 occupations of the 2000 Standard Occupational Classification. Each of them is classified by education and training categories. This allows for estimates of the education and training needs for the population as a whole and of the outlook for workers with various types of educational and training attainment. Since 1994, this classification system has been used for all employment projections that are carried out by the BLS every second years, always following the publication of a new US BLS projection.

Up to the latest projection published at the end of 2009, the BLS identified 11 education and training categories defined as the most significant source of education or training needed to become qualified in an occupation, also including non-educational paths of entry, such as on-the-job training and work experience. By construction, these categories were intended to be mutually exclusive and exhaustive, and BLS economists and other experts in the topic were asked to assign each occupation to one of these categories based on their knowledge and judgment. In consequence, the system did not show that an occupation might have multiple entry requirements, both on-the-job training and education. (The latter is often required because of its screening function. For example, only 11 percent of jobs in the three on-the-job training categories were mostly filled by workers with a high school degree or less. For jobs requiring moderate or long-term on-the-job training, employers often try to hire individuals with at least some college education, or even a bachelor's degree, before making a large investment in their training.)

This system has proved confusing, as it combines different dimensions of education, training, and work experience in a related occupation into one classification system. For example, in some occupations both postsecondary education and a long-term on-the-job training are important, but in the existing system these are two distinct and mutually exclusive categories. Other examples are occupations where both education and work experience in a related occupation are important. Also, the system does not include any category for education below the secondary level[1].

[1] At the same time we have to be aware of the fact that American high schools are very different and have different goals than many various types of secondary education institutions in European countries.

After some critical comments this approach was largely altered in 2009-2011 and at the end of 2011 a new system has been published, eliminating problems mentioned above and presenting a more complete picture of the education and training needed for entry into a given occupation. All occupations are assigned an education category, a training category, and a related work experience category, and the education categories include both high school and less than high school:

- *Entry level education* — represents the typical education level needed to enter an occupation. There are eight possible assignments for this category.
  1. Doctoral or professional degree
  2. Master's degree
  3. Bachelor's degree
  4. Associate's degree
  5. Postsecondary non-degree award
  6. Some college, no degree
  7. High school diploma or equivalent
  8. Less than high school
- *Work experience in a related occupation* — indicates if work experience in a related occupation is commonly considered necessary by employers for entry into the occupation, or is a commonly accepted substitute for formal types of training. Assignments for this category will be more than 5 years, 1-5 years, less than 1 year, or none.
- *Typical on-the-job training* — indicates the typical on-the-job training needed to attain competency in the occupation. Assignments for this category include internship/residency; apprenticeship; long-term, moderate-term, or short-term on-the-job training; or none.

Under the new system an education assignment for several occupations could be naturally different from the prior system. The new system assigns a typical entry level education, while the prior system assigned “the most significant source” of education or training. Therefore some occupations will have a different education level assigned than they did previously.

Some occupations could have more than one way to enter. The assignments under the new system describe the typical education needed to enter, and the typical type of on-the-job training required to be competent. The work experience in a related occupation assignment represents what is commonly considered necessary by employers or is a commonly accepted substitute for formal training. The three assignments complement each other in that they would represent a typical “path of entry” into the occupation, but they are not necessarily equal in importance for entry into the occupation.

BIBB/BAuA Erwerbstätigenbefragung (Germany)

Periodical employment surveys on qualification and working conditions have been conducted in Germany every 5-7 years since 1979 by the Federal Institute for Vocational Education and Training (BIBB). The last 2006 survey was conducted by the BIBB in cooperation with the Federal Institute for Occupational Safety and Health (BAuA). At present a new survey BIBB/BAuA-Erwerbstätigenbefragung 2012 is under preparation; its data will be not available before 2013 a most probably even before 2014.

When constructing OSPs, the ECP have had access to the database of all respondents of the last survey so far, BIBB/BAuA Erwerbstätigenbefragung 2006, that was focused both on the

job and on the matching between current job skill requirements and respondent´s qualification. The representative sample of 20 thousand respondents was selected from employed persons over 15 years of age having a paid work for more than 10 hours weekly (this definition covers 96 % of active labour force). The size of the sample allowed differentiation by occupational groups and identification of diverse target groups (such as old-age, female, non-formally qualified workers).

The 2006 survey had four main research themes: activities and requirements of, and access to, jobs; changing a job, job flexibility; use of qualification attained, job satisfaction and success; participation in lifelong learning. Correspondingly, the questionnaire was structured into four parts: questions focused on the current job (covering various aspects as job tasks, job skills requirements, other specific requirements, work load, working conditions, health, employment status, wage, changes and innovation); questions focused on matching the job and the job holder, i.e. to what degree does the job holder meets job requirements; questions focused exclusively on the job holder, on his/her educational and career history; and supplementary questions relating to the respondent and the firm.

Indagine sulle professioni (Italy)

The Italian Survey on Occupations was conducted in 2006-2007, and involved interviews with a sample of 16,000 respondents from the Italian working population in employment. Its final objective was to construct an information system capable of describing the characteristics of all existing occupations in the Italian labour market. A great advantage of the Italian survey lies in the fact that it was modelled on the O*NET system, thus making it possible to test the degree of similarity between the American O*NET and the Italian system (and in a lesser degree also the Czech survey *Kvalifikace*) and to verify the suitability of using the O*NET database for dimensions 3 through 7 also in the European context.

The survey is focused on measuring the importance and complexity level of about 400 variables for 810 individual occupations of a new occupational classification (derived from the official classification of the Italian Statistics Office). The questionnaire is divided into ten sections covering what is required of the worker to perform the job (education and training, occupation, knowledge, skills, abilities), what would affect his performance (aptitudes, values, work styles), and finally further characteristics of the job (transversal activities common to many different occupations, environmental conditions, specific activities not adequately represented in the questionnaire).

Kvalifikace (Czech Republic)

An extensive survey on qualification was also conducted in the Czech Republic at the turn of 2008 with a sample of nearly 6 thousand working active respondents. It followed upon a similar survey carried out in 2002-2003 and research into the employment situation of graduates implemented in 1997-1998. It was informed by indicators used as part of the US O*NET and the British Skills Survey, and took account of questions used in the ESS-2 as well as of three EQF dimensions (knowledge, skills, competence).

A substantial part of the survey was concerned with qualification requirements for each job, the qualification of each job holder and the extent to which school education and other skills contributed to the acquisition of the qualification. The information about various aspects or dimensions of qualification requirements for a job includes some 30 characteristics and about 50 indicators. This is why it has been possible to use the survey *Kvalifikace* not only for

constructing dimensions 1 and 2 of OSPs, but – together with the Italian survey *Indagine sulle professioni* – also for testing the degree of similarity between the outcomes of the US O*NET and both European surveys, and thus to verify the suitability of the O*NET database for constructing dimensions 3 through 7 also in the European context.

EURES

Besides sources already mentioned that all can be classified as *employee surveys* and/or as *expert surveys*, also *EURES* data sets coming under the category of *employer requirements* have been analysed. The European Job Mobility Portal *EURES* (*European Employment Services*) was set up at the European Commission in 1993 as a cooperation network designed to facilitate the free movement of workers within the European Economic Area. Its partners include public employment services, trade union and employers' organisations. Its main function is to advertise vacancies entered into the system by employers, its main objectives are to inform, guide and provide advice to potentially mobile workers on job opportunities as well as living and working conditions in the EEA, to assist employers wishing to recruit workers from other countries and to provide advice and guidance to workers and employers in cross-border regions. In recent years the offering has been between 600 and 800 thousand vacancies available from more than 20 thousand employers. The EPC have been obtaining the data from the EURES web page every May since the year 2007 up to now, and it is in this way capturing the instantaneous structure of educational requirements of employers across Europe.

The use of EURES has some pros and cons. Despite the considerable size of the EURES database its use is limited to about 10 % of the original sample as in some countries many ads do not specify education required. Moreover, the occupations presented are only classified at the ISCO 2-digit level. In order to disaggregate the EURES data from the ISCO 2-digit to the ISCO 3-digit more detailed national analyses of employer advertising have been used. Still, the EURES data is appropriate for an international comparison of qualification as required by employers within various groups of occupations, and the analyses carried out have confirmed a relatively high level of consistency in qualification requirements for jobs belonging to the relevant occupational groups in various countries.

However during recent years, the quality of EURES data (on occupation and particularly on education required) has gradually but markedly deteriorated. At the same time, the economic crisis has confirmed the well-known fact that requirements of employers are highly dependent on the phase of the economic cycle and therefore cannot be very well used for long-term predictions of skills requirements. In 2007, when demand for labour was very high and surpassed its supply, advertisements were very numerous and education was required less often and usually of a not so high level. In 2009 that is during the first wave of the financial and economic crisis demand for labour markedly fell down, far less advertisements were published (and the proportion of web ads increased) but education was required more often and of a markedly higher level. Analysing EURES database has proved that it is not possible to include it into the model. Yet it has been most interesting to use its results for comparing with results of other surveys.

Beside EURES also other extensive surveys of employer requirements based on advertisements in newspapers, journals and on the web and conducted in the Czech Republic in 2000, 2005, 2007 and 2009 have been analysed. A sufficient number – almost 28 thousand adds – contained qualification requirements for occupations at the ISCO 3-digit. The level of education, defined on a five-degree scale the same as in the case of EURES, has been

translated into the eight-degree scale. The existence of a comparatively long time series has made possible to formulate some interesting conclusions concerning the relationship between qualification requirements and the economic cycle- They have confirmed that requirements of employers are less demanding during the economic boom and a corresponding shortage of workforce.

* * *

Other international surveys and projects – such as the International Social Survey Programme (ISSP), the OECD International Adult Literacy Survey (IALS) from the nineties, or the new OECD Programme for International Assessment of Adult Competencies (PIAAC) just under way in many OECD countries – have been analysed and taken into account as well.

The EPC approach uses data coming from different sources, typically both from Europe and the US. To fully understand it and accept it, it has to be taken into account that any system of occupational skills profiles or requirements (be it US, European or of any single country) cannot describe all jobs in a given occupation. It always has to select only some representatives and will always be subject to certain fluctuations. One and the same occupation can and does have slightly different contents and qualification requirements, for instance, in the West and in the East of the United States, as well as in the United Kingdom and the Czech Republic, or in Spain and in Finland, and even in different regions or enterprises of a country. It is affected, for example, by national or even local tradition and environment of other occupations, by the character of the enterprise and its participation in the global trade, or by a different technology and technical equipment (as proved for example by an international survey of graduate position at the labour market CHEERS and REFLEX). This is another reason why we are convinced that information describing the contents and complexity of different jobs and occupations coming from the USA – that is from a country that is so diverse – is no worse than information coming from a European country or even from an international European survey.

The EPC have thus put together and used various types of information: different international and national classifications of occupations and of sectors, data gathered by the European Social Survey, American BLS data and German BIBB data and those contained in the US information system O*NET as well as in the Italian and Czech surveys.

In order to be able to use O*NET data also in Europe, a correspondence table for classifications of occupations has been completed using information and other support from the US Bureau for Labor Statistics. It has thus been possible to utilise the main benefit of the O*NET system that is able to define and quantify about 700 occupational units, far more than in Europe where only data at ISCO 3-digit level structured into 110-120 occupational groups are available.

1.4 The substantiation of using US data for calculating OSPs in Europe

After reading the methodology most users of OSPs will be perhaps asking whether it is appropriate to use US data, such as the O*NET and the Occupational Projection and Training Data, for calculating OSPs for European countries. Are not occupational structures within sectors in the United States and European countries too different? Are O*NET questions

perceived in the same way in Europe as in the US? Are data obtained for the O*NET database in the US similar to those that would be obtained in similar surveys in Europe?

Similar questions have been answered, of course, by the authors of this publication. They have been particularly related to dimensions 3 through 7, because the first two dimensions have been based either solely (as the second dimension - Fields of Education) or predominantly (as the first dimension - Qualification Requirements) on European data. On the other hand, for the calculation of dimensions 3 through 7 only O*NET data have been used.

In recent years two surveys based on O*NET questionnaires have been concluded in EU countries, Indagine sulle professioni in Italy and Kvalifikace 2008 in the Czech Republic.

The results of both surveys can be compared with O*NET data at the ISCO 2 digit level as well as at the ISCO 3 digit level. Correlation analysis was used for testing the degree of similarity between both European surveys and the O*NET.

Exploring similarities – correlation analysis

Correlation refers to a broad class of statistical relationships involving dependence. The dependence refers to any situation in which random variables do not satisfy a mathematical condition of probabilistic independence. In loose usage, correlation can refer to any departure of two or more random variables from independence, but technically it refers to any of several more specialized types of relationship between mean values. There are several correlation coefficients. The most common of them, the Pearson correlation coefficient, was used for this task.

The Pearson correlation coefficient is sensitive only to a linear relationship between two variables. It is obtained by dividing the covariance of the two variables by the product of their standard deviations.

The correlation coefficient $\rho_{X,Y}$ between two random variables X and Y with expected values μ_X and μ_Y and standard deviations σ_X and σ_Y is defined as:

$$\rho_{X,Y} = \operatorname{corr}(X,Y) = \frac{\operatorname{cov}(X,Y)}{\sigma_X \sigma_Y} = \frac{E[(X-\mu_X)(Y-\mu_Y)]}{\sigma_X \sigma_Y},$$

where E is the expected value operator, *cov* means covariance, and *corr* a widely used alternative notation for Pearson's correlation.

The Pearson correlation is defined only if both of the standard deviations are finite and both of them are nonzero. The correlation coefficient is symmetric: corr(X,Y) = corr(Y,X). The Pearson correlation is +1 in the case of a perfect positive (increasing) linear relationship (correlation), −1 in the case of a perfect decreasing (negative) linear relationship, and some value between −1 and 1 in all other cases, indicating the degree of linear dependence between the variables. As it approaches zero there is less of a relationship (closer to uncorrelated). The closer the coefficient is to either −1 or 1, the stronger the correlation between the variables.

Correlation with the O*NET data			ISCO 3D		ISCO 2D	
			Italy	Czech	Italy	Czech
Knowledge	01 Education and Training	Importance	0,812	0,771	0,848	0,919
		Level	0,814	0,743	0,823	0,817
	02 Arts and Humanities	Importance	0,845	0,870	0,921	0,995
		Level	0,870	0,893	0,925	0,845
	03 Social sciences, Economy and Law	Importance	0,855	0,771	0,930	0,923
		Level	0,872	0,925	0,938	0,993
	04 Sciences, Mathematics and Computers	Importance	0,817	0,804	0,811	0,836
		Level	0,821	0,820	0,818	0,870
	05 Engineering, Technology, Production	Importance	0,752	0,693	0,742	0,759
		Level	0,732	0,792	0,703	0,734
	06 Helath services	Importance	0,884	0,855	0,927	0,906
		Level	0,882	0,914	0,890	0,853
	07 Services	Importance	0,731	0,774	0,618	0,665
		Level	0,773	0,697	0,691	0,611
	08 Bussiness and Management	Importance	0,683	0,687	0,878	0,853
		Level	0,757	0,797	0,899	0,876
Skills	01 Cognitive skills	Importance	0,743	0,715	0,892	0,962
		Level	0,774	0,683	0,900	0,915
	02 Practical skills	Importance	0,766	0,670	0,814	0,859
		Level	0,763	0,711	0,795	0,735
	03 Communication in the mother language	Importance	0,886	0,836	0,950	0,953
		Level	0,834	0,841	0,926	0,978
	04 Comunication in foreign languages	Importance	0,338	0,291	0,428	0,491
		Level	0,489	0,536	0,596	0,602
	05 Numeracy + basic SMT concepts	Importance	0,474	0,507	0,512	0,484
		Level	0,528	0,461	0,640	0,697
	06 ICT/digital	Importance	0,835	0,895	0,818	0,756
		Level	0,856	0,929	0,825	0,875
	07 Learning to learn	Importance	0,787	0,703	0,851	0,815
		Level	0,797	0,714	0,917	0,958
Competence	01 Personal abilities	Importance	0,714	0,782	0,897	0,924
		Level	0,220	0,281	0,448	0,360
	02 Social abilities	Importance	0,830	0,861	0,923	0,912
		Level	0,848	0,763	0,922	0,964
	03 Methodical abilities	Importance	0,662	0,750	0,871	0,855
		Level	0,758	0,673	0,904	0,999
		min	0,220	0,281	0,428	0,360
		max	0,886	0,929	0,950	0,999
		avg	0,745	0,734	0,811	0,821

As can be seen, correlations are very high, mostly around 0.8, with two exceptions: for the level of *Personal abilities*, and for the level and importance of *Communication in foreign languages*.

The difference in the required level and importance of *Communication in foreign languages* is to be expected, of course, the knowledge of foreign languages is required of US residents less than of Italians and even more so of Czechs.

Personal abilities cover various kinds of competence as thinking creatively, leadership, originality, initiative, cooperation and so on. The fact that the linear correlation of European and US data in this dimension is so different points to a different perception of this type of

competence in the United States and Europe, which refers to other issues that are, however, outside the scope of our methodology.

On the whole, correlations are so high that we feel fully justified to use US data for constructing OSPs for European countries.

1.5 Transposition and aggregation

To find a safe way how to transpose both between various systems of classification and between various levels of classification is the prerequisite that makes possible to utilise data coming from different sources. Especially the use of the US data and systems has opened up problems of transposition, as US BLS data and projections and O*NET characteristics of individual occupations are based on the US classification (SOC). They have to be transposed to the ISCO in order to be linked to empirical data from European countries. The EPC have already prepared with the support of the US BLS a correspondence table for individual occupations as defined by the SOC and the ISCO. As the Eurostat have readily available data only at the ISCO 3-digit level (out of 19 countries examined by the EPC only 6 of them have data at the ISCO 4-digit level), occupational skills profiles have to be aggregated up to this level which currently contains 106 occupational groups. As sector-occupation employment matrices will be needed for the next step, and as US BLS data and projections of jobs/employment by industry are based on the North American classification of industries (NAIRIC), it is also necessary to map NAIRIC to the European classification of sectors NACE (rev.1).

Not only is it necessary to establish occupational skills profiles at a detailed level of individual occupations (occupational units) but for the same reason it is necessary to be very careful when aggregating them. Any aggregation to higher levels of classification and the transposition to sectors cannot be realized by simply adding together the values determined at a lower, more detailed level of individual occupations. Their specificity would be lost, as a range of different values would be substituted by their average. To ground analyses and projections of qualification requirements only on aggregated groups of occupations, without having the possibility of their disaggregation, and without respecting considerable differences in their distribution across sectors is questionable, as it impoverishes the information available.

The EPC have found a way how to maintain specific features of occupational skills profiles derived for individual occupations even after their aggregation to a considerably higher level (that is from the level of individual occupations – as defined by the SOC – to the levels of the ISCO 3-digit and 2-digit) by taking into account their sector-specific occupational structure (that is different proportional representations of individual occupations in different sectors). This is why the EPC are preparing a specific occupational skills profile for each sector where the occupation in question is significantly represented. (Problems of transposition and aggregation are discussed in detail in Chapter 3, and illustrated by an example showing how effective the sector-specific approach is. The same example is also used to illustrate what difference the sector-specific approach makes for each of the seven dimensions as discussed in Chapter 2.)

To sum up, the aggregation of occupational skills profiles determined at a more detailed level of occupations (that is of about 800 individual occupations) has to be sector-specific – that is, it is necessary to carry it out for each sector in question separately rather than across all

sectors. Then it reflects different job/employment shares of individual occupations in occupational groups at the ISCO 3-digit level in different sectors. In other words, it uses different occupational weights derived on the basis of US data which reflect the situation in the US economy (and whose use has to be confined within the limits of the respective occupational group at the ISCO-3 digit level and of the respective NACE sector). The reason is obvious: at higher levels of aggregation occupational groups contain several different occupations, the mix of occupations (their proportion, prevalence or domination) is different in each sector (having for example a different degree of concentration and exclusivity). Consequently there has to be a different, sector-specific occupational skills profile for each sector where the occupational group in question is represented, the number of occupational skills profiles being equal to the number of respective sectors. For some occupational groups it may be necessary to prepare up to 38 different profiles (the E3ME classification contains 41 sectors but three pairs of sectors have to be united into three new sectors due to data limitations).

The sector-specific approach yields very good proxy results that are much better than the results arrived at by using simple ways of aggregation (when only one qualification profile for any occupational group at the ISCO 3-digit level is used for all sectors). In this way, both crucial criteria will be met – the sufficiently detailed level of classification and the availability of data.

In all 29 European countries, which are part of the analysis and the projection of skill needs, there exist roughly 230-240 million jobs that can be divided into several thousand of sector-specific groups of occupation at the ISCO 3-digit level. The EPC propose to use the 0.01 % criterion of jobs (thus approximately 23.5 thousand), when selecting the smallest sector-specific group of occupation, for which the occupational skills profile will be calculated. Occupational skills profiles would then be calculated for roughly 900 sector-specific groups of occupation. (Occupational skills profiles for those very small sector-specific occupational groups that fall under the 0.01 % criterion will not be calculated, but they will be assigned characteristics of similar sector-specific groups, either of the same occupational group in another sector or of a related occupational group in the same sector.)

1.6 Consistency and measurability of occupational skills profiles

In order to achieve a reasonable degree of consistency, the structure of occupational skills profiles as proposed by the EPC basically conforms to the European Qualification Framework (see BOX 11). Their most important dimensions (the level of qualification requirements and the three dimensions of main characteristics) are defined exactly as in the EQF, and all available information on their characteristics has been restructured accordingly. Also other important European documents have been taken into account, notably the recommendations on key competences for lifelong learning.

BOX 11 European Qualification Framework

The EQF is a common European reference framework which links countries´ qualification systems together. Its construction has three main features. First, it defines eight reference levels spanning the full scale of qualifications, from basic to the most advanced levels. Second, the eight reference levels are defined in terms of learning outcomes described by generally applicable descriptors. Third,

learning outcomes – that is what a learner knows, understands and is able to do on completion of a learning process – are specified in three categories as *knowledge, skills* and *competence*.

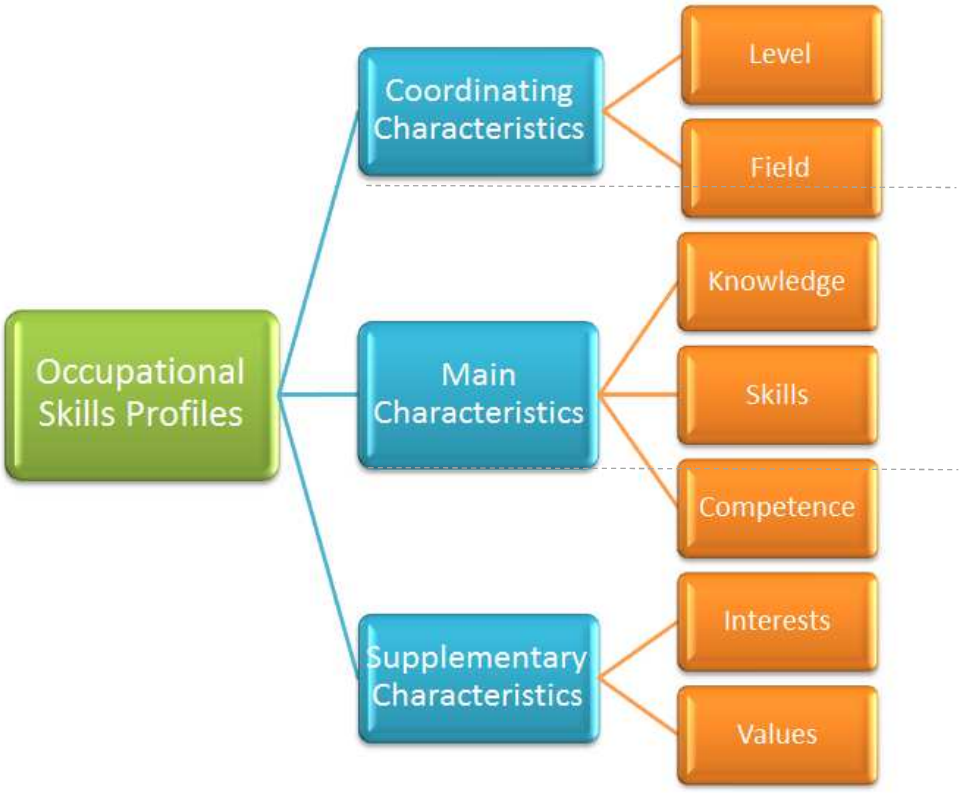
Still, a certain safety-catch has been introduced into the process: the outcome of the EPC activity – the entire information describing the development of occupational skills profiles of all relevant (sector-specific) occupations in Europe in the period 2000-2020 – should be understood only as an input information to be widely shared, commented on and discussed in various networks and with various stakeholders for a sufficient length of time. Modifications may include also changes in the used methodology but certainly would lead to some changes in characteristics of various occupations. During this process of adjustment, the ESCO taxonomy will be duly considered and used if possible once it is available.

2. Structure and Contents of Occupational Skills Profiles

Occupational skills profiles as proposed by the EPC summarise qualification requirements of occupations in a standard and comparable way. They structure characteristics essential to a given occupation into seven dimensions.

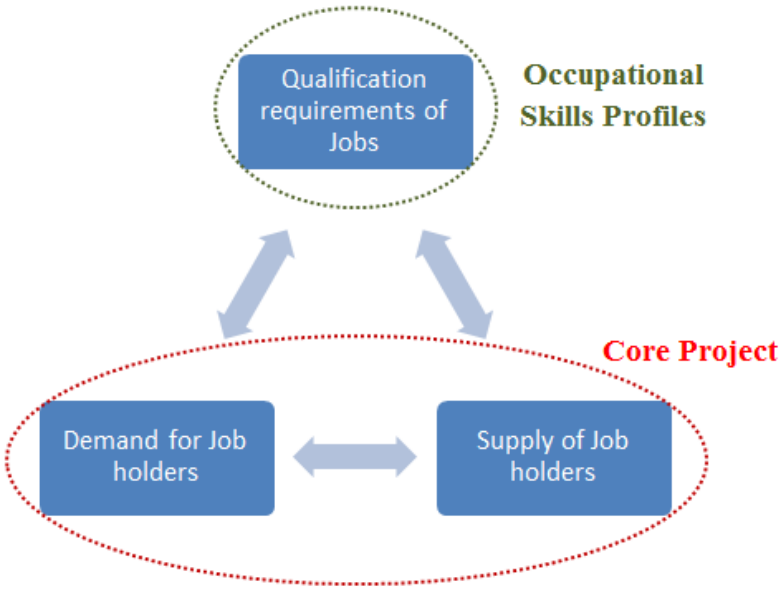
An Occupational Skills Profile has 7 main Dimensions forming 3 main groups further divided into 66 groups at the most detailed level (see FIGURE 1 below). The first two Dimensions – grouped together as *Coordinating Characteristics* – relate to the level of education and training required (and hence to the complexity of the occupation), and to the field of education and training required. Three further Dimensions – together referred to as *Main Characteristics* – contain what is required to do the job in terms of theoretical and factual knowledge, cross-functional skills, and personal, social and methodological abilities. The last two Dimensions – under the heading of *Supplementary Characteristics* – add information relating to the profile and orientation of work, such as occupational interests (preferences for work environment) and work values (important to job satisfaction).

FIGURE 1: Occupational Skills Profile - Main dimensions



The focus here is on the requirements of jobs. By comparing the estimates here with the estimates of qualification supply from the core projections produced in the main project (Wilson et al 2010) it is possible to compare job's requirements with qualifications of job holders. (See FIGURE 2 below for how the OSPs relate to the core projections.)

FIGURE 2: The OSPs and the Core Projections of Supply of and Demand for Qualifications



The structure of occupational skills profiles is basically consistent with the European Qualification Framework. The definition and contents of the most important dimensions correspond directly to the EQF: for the first dimension eight levels of reference were used originally, although later they have been aggregated into three broad levels corresponding to the Core project, and the third to the fifth dimensions are defined in terms of learning outcomes, specified in the three categories of knowledge, skills and competence.

As for the contents, this basic structure has been filled up with data taken mainly from two major sources. (The way how OSP Dimensions have been generated is described in detail in the Annex.) The first one is the European Social Survey (ESS) whose data have been used for the elaboration of both *coordinating characteristics*. The second one is the O*NET whose data have been used for the elaboration of the three Dimensions of *Main Characteristics* and the two dimensions of *Supplementary Characteristics*, and also contributed to the determination of the first Dimension. Out of the six O*NET domains (see BOX 4) only those have been used that concern general qualification requirements, that is those not specific for a single occupation. (Three domains – *Labour Market Characteristics*, *Occupation-Specific Information* and *Experience Requirements* – and four parts from other domains – *Detailed Work Activities, Education, Abilities* (partly), and *Organisational Context* – have been excluded. The same approach has been followed by the Italian survey *Indagine sulle professioni* that used only the relevant parts of the O*NET defining them as *Knowledge, Skills, Abilities, Work Values, Work Styles,* and *Generalised Work Activities*.)

2.1 Coordinating Characteristics

2.1.1 Dimension I – Level of Qualification Requirements

The first Dimension describes the level of qualification requirements. Originally, the eight-level scale as defined by the European Qualification Framework (EQF) was used, serving as the vertical axis of the profile. The 1st dimension of OSPs is defined for all groups of jobs at the level of ISCO 3 digits occupations (about 110-120 groups of occupations) x 38 industries, its last version is dynamic in time. As OSPs characterise requirements of the job, their 1st dimension cannot be mistaken for the level of formal education of job holders.

However, in the current set of workbooks the 1st dimension has been aggregated into a three-level scale corresponding to the three broad levels (Low, Medium and High) adopted in the Core project. Low level includes level 1 – 2 of the eight-level scale, Medium level includes level 3 – 5 of the eight-level scale, and High level includes level 6 – 8 of the original eight-level scale defined by EQF. The degree of aggregation in the core project has also decided that the 1st dimension is defined for groups of jobs at the level of ISCO 2 digits occupations (only 27 groups of occupations) x 38 industries.

Two values for each occupation are indicated: the *percentage distribution* of individual characteristics (making together the profile of the occupation) across all levels of complexity (their total making 100 %) and the required *average years of education*. To fill it up, the EPC has utilised all available relevant data sources for developing one sole vertical indicator of the required level of qualification.

Data sources used

Available data sources are relatively limited. They use three different approaches. In *job holder (employee) surveys* job holders are questioned and surveyed, and in that way a description of qualification requirements of a given job is obtained. Research studies and surveys of this type are perhaps the most numerous and enjoy the longest tradition. It is therefore possible to acquire, in addition to extensive evidence from national projects, some interesting international data. Both international and main supplementary national sources used – the *European Social Survey (ESS)*, the US *Occupational Information Network (O*NET)*, the German *BIBB Erwerbstätigenbefragung*, the Czech *Kvalifikace* and the Italian *Indagine sulle professioni* – belong to this category.

Further supplementary sources have a different character. *Expert analyses* define qualification requirements of every job in a given area on the basis of a qualified judgment of a selected group of experts. This approach has been used for the *US BLS Education and Training Requirements Categories* (and partly also for the O*NET).

Employer requirements vary from employers advertising new jobs or vacancies to special surveys concerning their current or possible future employees or expert studies of various recruitment agencies. However, most of them are not as systematic as the other two approaches, and can be used only exceptionally. EPC analyses bring further arguments why employer requirements surveys are not suitable for long-range projections (see Chapter 1.3 on *EURES, European Employment Services)*.

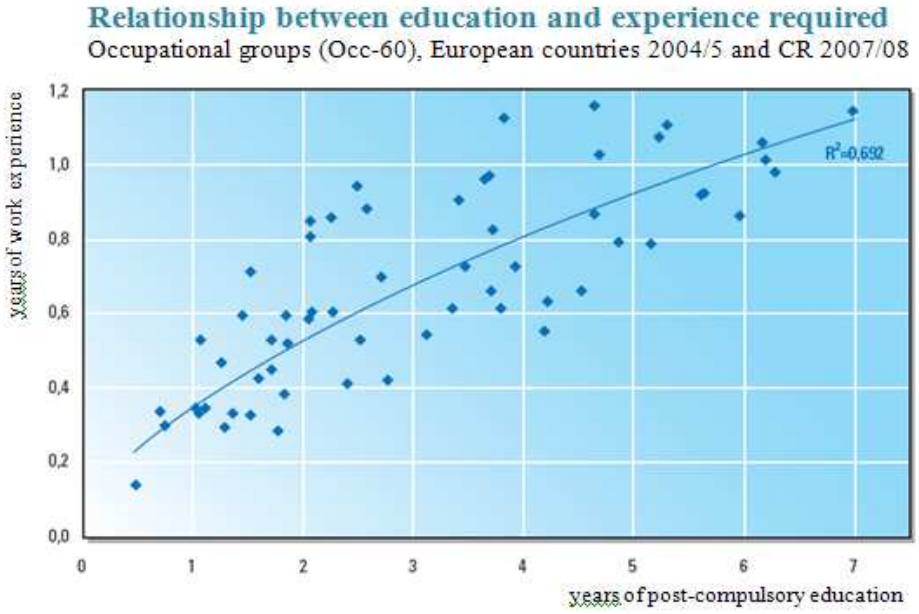
It is important to note that practically all sources define the level of qualification requirements in terms of the education level attained (alternatively the required number of years of

education or the certificate obtained), and this information has to be transposed into the vertical EQF scale.

European Social Survey ESS

The special module of the ESS-2 (and ESS-5, to be available partly in November 2011 and partly in the beginning of 2012, see Chapter 1.3 on *ESS*) contained three questions influenced mainly by the British Skill Survey and US research. They focused on the identification of skill needs and other job characteristics, defined by the length of post-compulsory education and by the length of work experience. This fact has made possible to develop an overall indicator of the level of qualification requirements defined as a sum of both time-related data. Furthermore, it has enabled to analyse the relationship between the length of the necessary education or vocational training and the length of the necessary practical experience. Although the two characteristics are related, the link is not so close. There are jobs at the labour market characterized by strong demands in terms of the length of education and vocational training which, at the same time, do not require extensive practical experience. There are also jobs where the reverse is true. However, in about 70 % of cases the requirements for previous education and practical experience match (FIGURE 3).

FIGURE 3



A significant advantage of ESS-2 and ESS-5 is also the fact that they make possible as one of few European surveys to analyse in a consistent way the development in time and thus to try to analyse changes within individual occupations. As the time-lag is only six years, it is necessary to extrapolate them to a ten-year period used in the model. Luckily enough we are not limited only to ESS results, it is possible to combine them with those of the O*NET and the BLS in order to test resulting changes.

The ESS-2 and ESS-5 data also allow us to explore the relationship between education attained by the respondent and education required by the job (TABLE 1 for ESS-2). Around 2005 about 15 % of the employment in Europe displayed a certain lack of qualifications,

while approximately 18 % (30 % for higher education graduates) attained education higher than required. On the other hand, about a quarter of jobs requiring tertiary qualifications are filled with people with a lower level of education. Even so, the relationship between education attained and required is relatively strong as around two thirds of the employed do jobs that roughly correspond to their education.

TABLE 1

Relationship between education and qualification required

European Social Survey, 2004/05

What is the highest level of education you have attained?	*How many years of post-compulsory education does your job require?*									
	0	<1 year	2 years	3 years	4-5 years	6-7 years	8-9 years	10+ years	Total	Average length
Primary – ISCED 0+1	3,0%	1,0%	0,4%	0,8%	0,3%	0,1%	0,0%	0,0%	5,7%	1,2
Lower secondary – ISCED 2	6,9%	4,0%	2,4%	3,3%	1,8%	0,2%	0,2%	0,1%	18,9%	1,6
Upper secondary – ISCED 3C	3,5%	3,5%	2,6%	7,6%	3,2%	0,5%	0,2%	0,1%	21,3%	2,4
Upper secondary – ISCED 3AB+4	3,0%	3,8%	3,4%	6,3%	8,4%	2,4%	0,6%	0,3%	28,2%	3,2
Tertiary – 5B	0,2%	0,4%	0,4%	1,3%	1,7%	0,7%	0,3%	0,1%	5,1%	4,2
Higher short – ISCED 5A short	0,4%	0,5%	0,5%	1,5%	3,0%	2,3%	1,2%	0,5%	9,8%	5,0
Higher long – ISCED 5A long + 6	0,3%	0,4%	0,3%	0,7%	2,4%	2,5%	2,6%	1,8%	10,9%	6,5
Total	**17,2%**	**13,7%**	**10,0%**	**21,5%**	**20,9%**	**8,7%**	**5,2%**	**2,9%**	**100,0%**	**3,2**

The comparison of quite new European Social Survey data (ESS-5, conducted 2010-2011) containing a module that explores education required and attained in 25 European countries and ESS-2 data (surveyed 2004-2005) makes possible to carry out not only detailed analyses of mismatches & imbalances between all European countries involved in ESS, but also analyses of changes between both surveys. They will be included in the final text in 2012.

Data about qualification requirements generated on the basis of both characteristics as defined in the ESS-2 and ESS-5 were translated into the eight-degree scale as defined by the EQF. Based on the data from the ELFS 2004-2005 and from the ELFS 2010 (and projection form 2011) the characteristics of individual jobs are weighed again for the purpose of further analyses and assigned to groups of occupations in line with the ISCO 3-digit and to groups of sectors in line with the NACE 2-digit.

US BLS Education and Training Requirements Categories

The US BLS classification system can be used to estimate the number of jobs that will fall into each education and training category. This provides information on the current and future training needs of the workforce. The categorisation of occupations by qualification requirements based on *Expert analyses* significantly differs from the results of surveys of qualification requirements based on job holders. The most important difference is the fact that job holders surveys usually put each occupation under more categories indicating their average, median and variation, whereas expert surveys indicate only one exclusive category, differing estimates of individual experts usually are not published. It is thus possible to provide for each level of qualification requirements the list of corresponding occupations, in contrast to job holders surveys where an occupation is often listed under more levels.

TABLE 4 provides the current employment distribution for 11 education and training categories (note on changing classification systems, see Chapter 1.3 on *BLS*). It includes not

only the data from the last (2008-2018) employment projection (published in 2010) but also from the previous ones starting in 1996 (the next BLS projection for the period 2010-2020 containing analogous data for 2010 will be published in February 2012). The total numbers of occupations by education and training category are also listed.

TABLE 4

Number of occupations by education ant training category, 1996-2008

Most significant source of education and training	1996	2002	2004	2006	2008
First professional degree	8	9	13	13	13
Doctoral degree	6	8	9	10	11
Master's degree	9	32	35	33	32
Bachelor's degree, plus work experience	15	32	35	35	33
Bachelor's degree	69	102	107	114	112
Associate degree	15	37	42	41	42
Postsecondary vocational award	31	47	51	50	55
Work experience in a related occupation	36	47	45	48	48
Long-term on-the-job training	83	86	89	91	87
Moderate-term on-the-job training	119	186	189	183	179
Short-term on-the-job training	119	138	139	135	138
Total	510	724	754	753	750

The basic advantage of the BLS database is the possibility to analyse changes of qualification requirements within occupations since 1996 up to the present (new requirements reflecting the situation in 2010-2020 will be available at the beginning of 2012). The BLS database is one of the three main sources for the dynamisation of inherent changes of qualification requirements of all occupations in time.

O*NET

Four questions of the O*NET questionnaire concern directly the level of qualification required for the job. They relate to the required level of education, to the required related work experience, to the required on-site or in-plant training, and to the required on-the-job training. They cover all facets of qualification as well as their mutual relationship, which is only illustrated by TABLE 5.

TABLE 5

Average length of practical training/experience by required level of education

	Average lenght of ….., in months		
Required Level of Education	**On-Site or In-Plant Training**	**On-the-Job Training**	**Related Work Experience**
Less than High School	9,2	10,9	21,9
High School Diploma	28,3	34,5	69,2
Post-Secondary Certificate	14,3	17,4	35,3
Some College	8,0	9,7	26,1
Associate's Degree	9,8	11,4	30,9
Bachelor's Degree	22,0	27,5	89,0
Post-Baccalaureate Certificate	2,1	2,6	7,9
Master's Degree	5,5	7,0	27,1
Post-Master's Certificate	0,7	0,8	3,1
First Professional Degree	1,7	1,9	5,1
Doctoral Degree	3,4	3,8	12,7
Post-Doctoral Training	2,8	3,2	8,3
Total	9,0	10,9	28,1

A great advantage of the O*NET is the fact that its database has been formed since 2003, and at least since 2005 is consistent in time both from the point-of-view of job characteristics examined and from the point-of-view of the classification of occupations. The EPC has been thus in position to use the O*NET database also for analysing changes of qualification requirements within occupations. The EPC have even tried to analyse data from older D.O.T. surveys (implemented every ten years in 1950-1990) and to compare them with current O*NET data, so as to examine long-term changes within occupations, however without success, as the older and newest surveys are too inconsistent (particularly in the classification of occupations and in the assessment of qualification requirements).

BIBB/BAuA Erwerbstätigenbefragung

Data coming from the German 2006 Employment Survey (more see Chapter 1.3 on *BIBB*) have been also used for defining the 1st and 2nd dimensions of the OSP. The data of active respondents are transformable both to the NACE classification (38 sectors) as well as to the ISCO 3 digits occupational classification (about 110-120 groups of occupations). TABLE 2 only illustrates one aspect of this approach, the matching between qualification required and actually achieved has been acceptable for more than two thirds of respondents.

TABLE 2 Relationship between qualification required and achieved

BIBB/BAuA Erwebstätigenbefragung

What is the highest level of education you have attained?	Comparison of last qualification with present job			
	Present job matches with what the qualification prepares for	Present job is related to the qualification	Present job has nothing to do with the qualification	Total
Primary - ISCED 0+1	0,1%	0,0%	0,0%	0,1%
Lower secondary - ISCED 2	0,0%	0,0%	0,0%	0,1%
Upper secondary - ISCED 3C	15,3%	17,2%	19,2%	51,7%
Upper secondary - ISCED 3AB+4	3,5%	3,5%	3,4%	10,4%
Tertiary - ISCED 5B	4,5%	4,8%	3,5%	12,7%
Higher short - ISCED 5A short	3,6%	4,6%	2,2%	10,3%
Higher long - ISCED 5A long + 6	5,0%	6,9%	2,7%	14,6%
Total	31,8%	37,1%	31,1%	100,0%

Kvalifikace

One of the objectives of the Czech survey *Kvalifikace 2008* was to develop, test and make an empirical map of Qualification Profiles of jobs existing in the Czech Republic at the turn of 2008. The survey replicated the three questions about qualification contained in the ESS-2 in 2004-2005 and added further two questions: *What education do you consider to be the most appropriate for the job you are currently doing?* (the answers involved 12 different levels of education or types of school ranging from incomplete basic education to a doctoral degree so as to cover the widest possible spectrum of options), and *How does your qualification meet your current job requirements?* (three answers possible – adequate qualification, over-qualification, and under-qualification).

The data provided by *Kvalifikace 2008* have also made possible to explore the relationship between education attained by the respondent and education required by the job. Although the analysis has confirmed a close relationship between the two characteristics, at the same time it has pointed to certain stereotypes in assessing qualification requirements that are influenced by specific traditional features of the Czech education system. This is not exclusively Czech situation, as similar stereotypes exist also in other countries. These stereotypes are manifested, on the one hand, by certain helplessness on the part of respondents as regards the choice of less traditional levels or types of education about which they might not have enough information – e.g. follow-up courses, post-secondary studies, tertiary professional schools, bachelor programmes. On the other hand, specific levels of education are traditionally linked to a specific length of study leading to their attainment, and post-compulsory education lasting 3 and 4-5 years is required far more than in other European countries.

TABLE 3

Relationship between education required and its length

Kvalifikace 2007/08, Czech Republic

What level of education do you think is adequate for your job?	*How many years of post-compulsory education does your job require?*									
	0	<1 year	2 years	3 years	4-5 years	6-7 years	8-9 years	10+ years	Total	Average length
Basic education suffices	5,9%	0,5%							6,4%	0,1
Upper secondary up to 3 years	3,0%	2,5%	3,1%	3,7%					12,3%	1,6
Up.Sec. without maturita, 3+ years	2,5%	2,8%	2,2%	20,6%	1,9%				30,0%	2,6
Up.Sec. with maturita – vocational		0,7%	0,9%	3,7%	4,8%				10,1%	3,5
Up.Sec. with maturita – technical		1,3%	0,7%	2,5%	15,4%	0,5%			20,4%	4,1
Up.Sec. with maturita – general		0,7%	0,2%	0,4%	2,0%	0,1%			3,4%	3,5
Maturita study for apprentices			0,2%	0,2%	0,2%	0,1%			0,7%	3,6
Post-maturita programmes			0,2%	0,2%	1,1%	0,4%			1,9%	4,5
Tertiary not HE					0,5%	0,5%	0,2%		1,2%	6,0
HE – bachelor´s					1,2%	0,8%	0,9%		2,9%	6,3
HE – master´s						1,6%	7,1%	1,8%	10,5%	8,5
HE – doctoral or similar							0,1%	0,3%	0,4%	10,0
Total	**11,4%**	**8,5%**	**7,5%**	**31,3%**	**27,1%**	**4,0%**	**8,3%**	**2,1%**	**100,0%**	**3,6**

The data provided were translated into an eight-degree scale corresponding to EQF definitions, and then they were weighed to become representative of the working population in the Czech Republic. A comparison of the results of both the Czech ESS-2 and *Kvalifikace 2008* provided conclusions similar to those resulting from other analyses. When jobs are divided into eight levels of qualification requirements, the resulting curves expressing the

intensity levels are very similar. Virtually identical is also the overall average level of qualification requirements of around four in both cases.

The synthesis

The final step in defining the level of qualification requirements has been a synthesis of all approaches under review and the development of a resultant vertical indicator on the eight-degree scale as described by the EQF. However, in this report the eight-degree scale has been transformed (aggregated) to a three-degree scale (low, medium and high qualification) as required by the Core project.

The main problem has concerned the weight that the individual approaches represented in the synthetic indicator should have, since their relevance in terms of the Europe-wide context varies significantly. Although the EPC have managed to obtain a lot of new information about them during data processing and ensuing analytical work, it has not been possible to identify their relevant weights on this basis, as such a way would still remain subjective to a large degree. Therefore the EPC have developed by means of a factor analysis as an important means of guidance a statistical model determining their mutual relationship, and tested its consistency. Only on this basis the resulting synthetic indicator could have been set, and some important conclusions arrived at.

First of all, the relationship between the five approaches applied (ESS, O*NET, BLS, BIBB, Kvalifikace) is so close that they may be expressed by a single, very robust factor covering, *en bloc*, 86 % of all information about the qualification requirements. This confirms a high level of consistency of this model, and enables us to establish an overall (synthetic) indicator of qualification requirements for each occupational group. The analysis has also shown the weight of respective surveys in the factor model which has become very important for determining the weight of each of the surveys in the final model of the 1st dimension of the OSP. Further criteria include the robustness of respective surveys, their international/national character, the possibility to be used for the dynamisation of changes of qualification requirements within occupations etc.

In the final model of the 1st dimension of OSPs the most important role is played by the data from the *European Social Survey* (ESS) that account for 25 % of the information contained in the resultant indicator, and are at the core of the cluster. They are followed by the data form the German and both American surveys, all of them accounting for 20 %, the Czech survey has the least weight, accounting for 15 %.

The following Figure illustrates the proportion of respective levels of qualification requirements for 27 EU countries corresponding to the jobs structure by sector (NACE; 38 sectors) and by occupation (ISCO 3 digit) and their qualification requirements in 2010. At the same time, its colour coding indicates the aggregation of the eight-level scale to the three-level scale (Low, Medium and High) adopted in the Core project.

Second, various approaches have led to somewhat different results as regards the ranking of qualification requirements of groups of occupations on the eight-degree scale. These differences are smaller for some occupational groups (the smallest size of the span is only 0.03 points), while for others they are larger (the largest size of the span is 1.56 points). However, the differences are not such as to impair the consistency of the evaluation of all occupational groups and their ranking on the scale (the average size of the span is 0.61). Moreover, the average level and length of education attained by job holders is closely related to the resultant indicator of qualification requirements of their jobs. This relatively strong relationship is yet another confirmation of a high degree of the consistency and credibility of the synthetic indicator.

In order to illustrate what difference the sector-specific approach makes when determining an occupational skills profile, the same example is used throughout in this chapter as well as in Chapter 3. It compares three occupational skills profiles, determined for the sector NACE 22 *Publishing, printing and reproduction of recorded media* across all occupational groups, for the occupational group ISCO 245 *Writers and creative or performing artists* across all sectors, and for the occupational group ISCO 245 specific in the sector NACE 22. (The result concerning the first dimension *Level of Qualification Requirements* is indicated in FIGURE 4.)

FIGURE 4 Dimension I – Level of Qualification Requirements

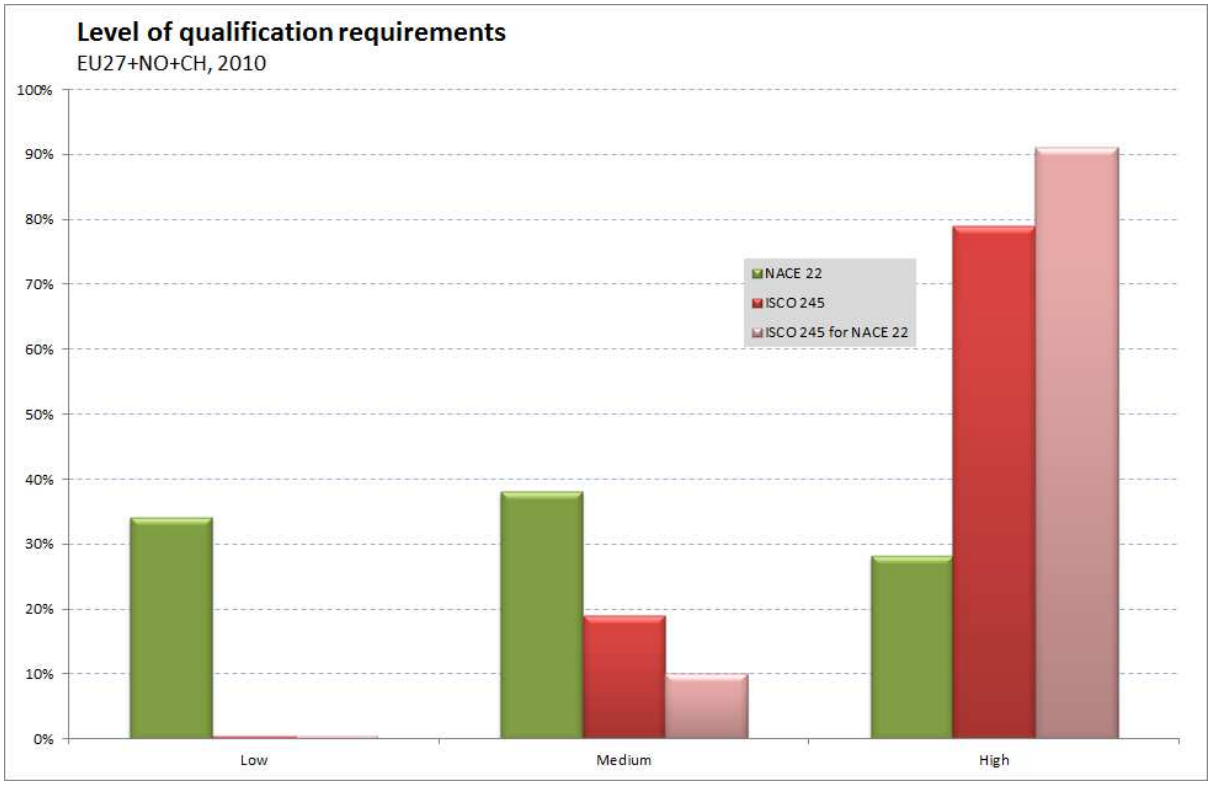


Figure 4 clearly indicates the effect of the sector-specific approach as applied by Occupational Skills Profiles. The proportion of eight EQF levels of qualification requirements taken for the whole NACE 22 sector – that is irrespective of occupational group required – is indicated in green, and for whole occupational group ISCO 245 – again irrespective of the sector required – in red. However, when both parameters are taken into account at the same time, when qualification requirements are determined for one occupational group (ISCO 245) within one sector (NACE 22) only, that is when the sector-specific approach is applied, the results change quite markedly as indicated in mauve. (The same colour scheme is also used for other figures.)

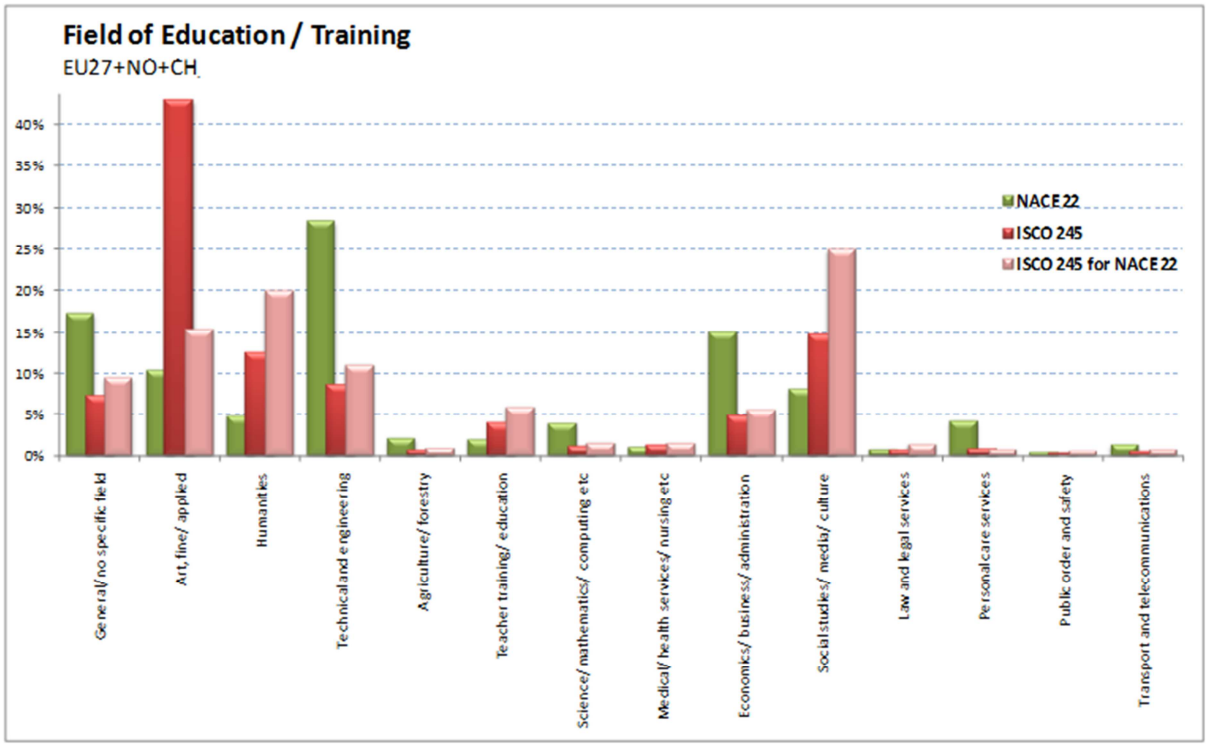
2.1.2 Dimension II – Field of Education/Training

BOX 12 Fields of Education/Training

General / no specific field
Art, fine / applied
Humanities
Technical and engineering
Agriculture / forestry
Teacher training / education
Science / mathematics / computing etc
Medical / health services / nursing etc
Economics / commerce / business / administration
Social studies / administration / media / culture
Law and legal services
Personal care services
Public order and safety
Transport and telecommunications

The second Dimension describes the field of education/training. Again, a relative, percentage distribution of the given occupation across various fields is indicated (i.e. the total making 100 %). The fourteen groups of fields of education and training (see BOX 12) have been defined according to the International Standard Classification of Education (ISCED). The difference made by the sector-specific approach is shown in FIGURE 5.

FIGURE 5 Dimension II – Field of Education/Training



2.2 Main Characteristics

As already stated, the EQF describes qualification requirements in terms of learning outcomes (Cedefop 2009). The basic structure of qualification profiles follows the structure of the EQF not only vertically, by using its eight levels, but also horizontally, by structuring relevant O*NET data into three dimensions – knowledge, skills and competence – as defined by the EQF.

Although learning outcomes have been differentiated into three different categories (described each in a separate column), they still form a continuum, and should be "*read across*" – "*this is the knowledge that is used with the skills in this area of competence*" (Mike Coles 2007, 2). "*Reading across the EQF descriptors for the (given) level we find the knowledge acquired is first defined. This knowledge is used in ways described in the second column where cognitive and practical skills depend on it. The application of these skills (and knowledge) is carried out in contexts defined in the third column in terms, for example, of the level of autonomy and responsibility that has to be exercised*" (ibid, 13).

The structuring of O*NET data has been relatively straightforward as regards the first category, *knowledge*. As regards the other two categories, it has been necessary to differentiate between *skills* and *competence,* and to handle adequately generic skills, stressing their importance.

2.2.1 Dimension III – Knowledge

As defined by the EQF, "*knowledge* means the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles and theories and practices that is related to a field of work or study. In the context of the EQF, it is described as theoretical and/or factual."

This dimension is structured into 8 main areas of knowledge, further subdivided to 32 sub-areas (BOX 13). Its structuring is based on the corresponding part of the O*NET model (originally containing 10 areas sub-divided to 33 sub-areas), however adapted to the structure of the ISCED classification (originally 8 areas further sub-divided to 25 sub-areas).

BOX 13 Dimension III Knowledge – 8 main areas and 32 sub-areas

Education and Training:
Education and training

Humanities and Art:
Fine arts, Communications and media, Design, English language, History and archaeology, Philosophy and theology

Social science, economics and law:
Psychology, Sociology and anthropology, Economics and accounting, Law and government

Science, mathematics and informatics:
Biology, Physics, Chemistry, Geography, Mathematics

Technology, production and construction:
Production and processing, Food production, Computers and electronics, Engineering and technology, Mechanical, Building and construction

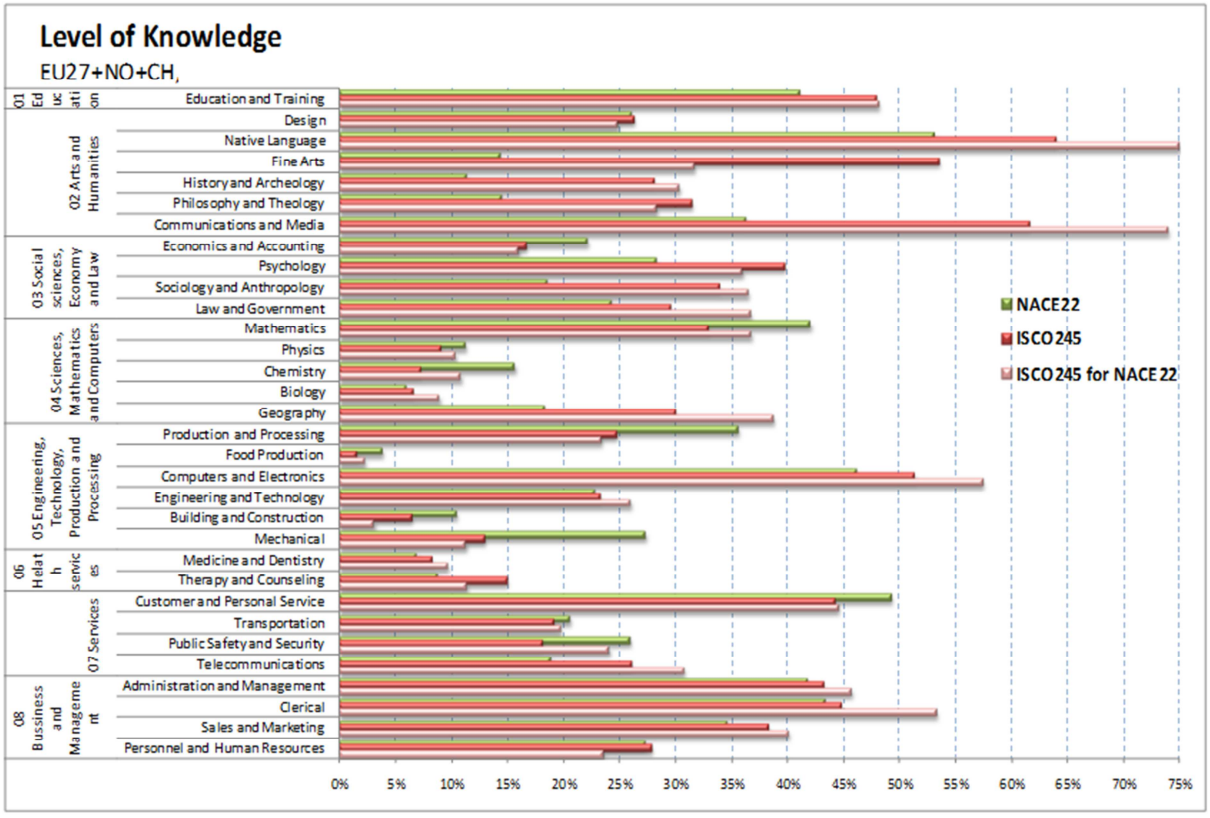
Business, administration and management:
Administration and management, Clerical, Sales and marketing, Personnel and human resources

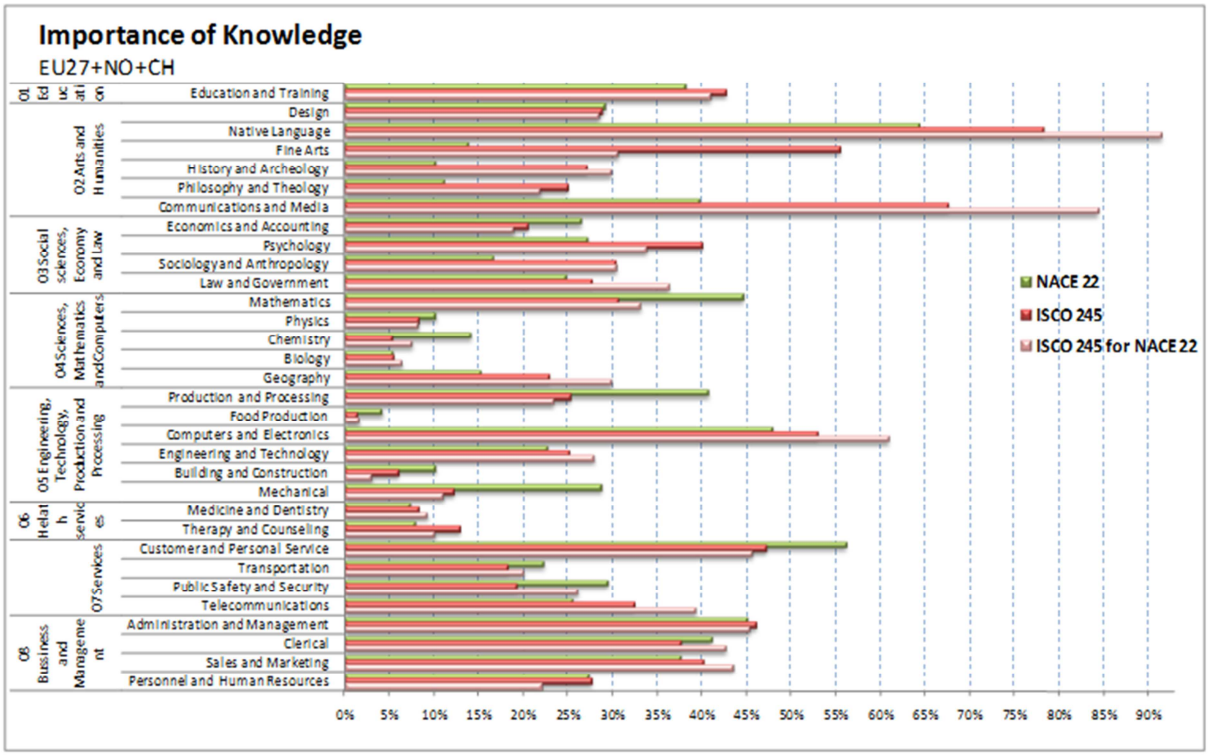
Health and social care:
Medicine and dentistry, Therapy and counselling

Service:
Customer and personal service, Public safety and security, Telecommunications, Transportation

For knowledge, two characteristics are indicated: the *Level* required (relating to the complexity of the occupation), and the *Importance* for the given occupation. Both characteristics are indicated as percentage values and shown in FIGURE 6.

FIGURE 6 Dimension III – Knowledge





2.2.2 Dimension IV – Skills

As defined by the EQF, "*skills* means the ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the EQF, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments)."

While the EQF makes distinction only between cognitive and practical skills, the structuring of this category has to be more detailed and explicitly focused on relevant generic skills. Therefore key competences for lifelong learning (BOX 14) have been taken into account as far as possible – that is unless they come under the category *Competence* or are not supported by O*NET characteristics.

BOX 14 **Key competences for lifelong learning**
Recommendation of the European Parliament and of the Council, of 18 December 2006

The Recommendation defines eight main domains:

the category Skills contains five of them (*Communication in the mother tongue, Communication in foreign languages, ICT/digital competencies, Numeracy and competencies in mathematics, science and technology, and Learning to learn*),

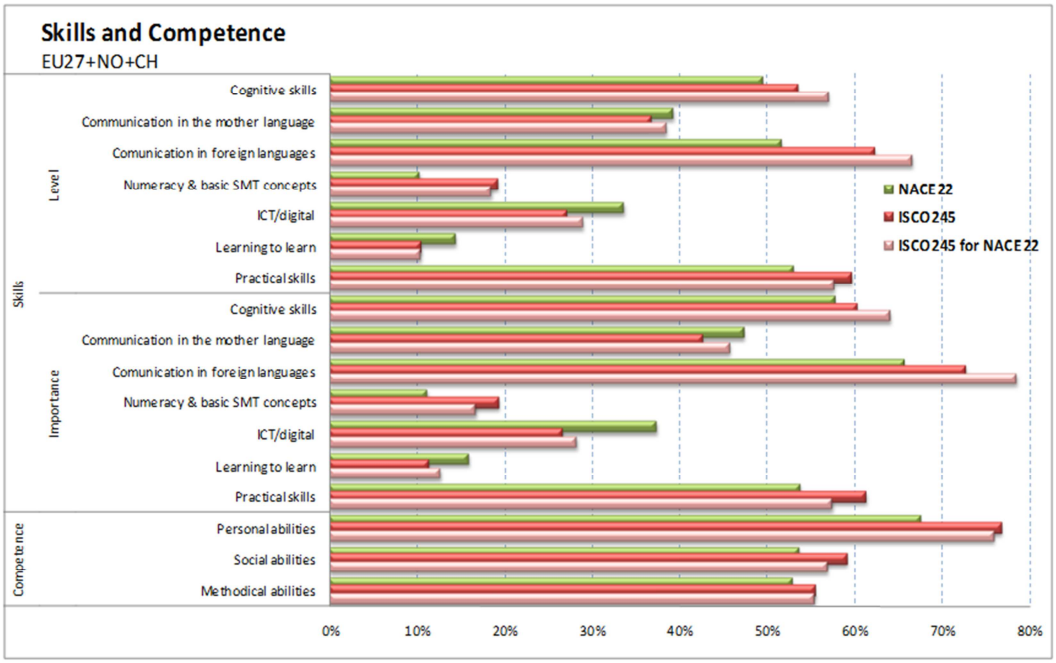
two fall under the category Competence (*Sense of entrepreneurship and initiative, and Interpersonal/social and civic competencies*),

one is not supported by O*NET characteristics (*General culture/cultural awareness and expression*).

As a result, the Dimension IV – Skills is structured as follows: *Cognitive skills, Communication in the mother language, Communication in foreign languages, Numeracy and basic SMT (science, mathematics, and technology) concepts, ICT (Information and Communication Technologies)/digital skills, Learning to learn*, and *Practical skills.*

Relevant O*NET parts *Basic Skills* and *Cross-Functional Skills* have been used. Two characteristics are indicated, the *Level* required (relating to the complexity of the job/occupation) and the *Importance* for the given job (occupation), both as percentage values. FIGURE 7 illustrates two dimensions – Skills and Competence.

FIGURE 7 Dimension IV – Skills and Dimension V – Competence



2.2.3 Dimension V – Competence

As defined by the EQF, "*competence* means the proven ability to use knowledge, skills and personal, social and/or methodological abilities in work or study situations and in professional and personal development. In the context of the EQF, competence is described in terms of responsibility and autonomy". Although the term *competence* is often used in a narrower sense (and then also in the plural), the above definition reflects the consensus that there is a certain progression between the three categories – not only knowledge, but also skills needed for its application, and also other abilities (social and personal competences, attitudes and values) indispensable for professional conduct.

Especially in European countries (as Germany, France, and the Netherlands) "competence is defined as ´capacity´ in relation to a broad occupational field. It is a multi-dimensional concept, combining different forms of knowledge and skills, as well as social and personal qualities. It relates to a person´s ability to draw on multiple resources to deal with a given work situation (Cedefop 2009, p. 19)". This broad definition is an outcome of a quite long development. Compare f.i. two short quotations (Rychen, D.S./Salganik, L. H. (Eds.), 2001): „Competence can generally be understood as knowledge times experience times power of

judgment" and "competences generally imply complex action systems encompassing not only knowledge and skills, but also strategies and routines needed to apply knowledge and skills, as well as appropriate emotions and the effective self-regulation of these competences".

In order to differentiate the abilities coming under the category *Competence* from other abilities coming under the category *Skills*, respective detailed descriptors defining the eight EQF levels of have been used for guidance (BOX 15).

Relevant O*NET characteristics relating to responsibility and autonomy (as defined by EQF descriptor) shave been further structured into *Personal abilities*, *Social abilities* and *Methodological abilities*. Only one characteristic, the importance, is indicated, again as a percentage value.

BOX 15 EQF descriptors defining eight levels of the category Competence

They include f.i.: Innovation, Creativity, Integrity, Authority, Leadership, Independence, Taking responsibility for managing professional development, Taking responsibility for the evaluation and improvement, Taking responsibility for completion of tasks, Reviewing and developing performance of self and others, Exercising self-management within the guidelines, Exercising management and supervision in contexts where there is unpredictable change, Supervising work of others, Working/studying with some autonomy, Taking responsibility for decision-making in unpredictable conditions, Adapting own behaviour to circumstances in solving problems.

2.3 Supplementary Characteristics

The last two dimensions of occupational skills profiles have a rather different character. They try to define certain general qualities of the job (occupation) which may (or may not) more or less correspond to those of the job holder. As both dimensions focus on the relationship between the job and the job holder, they can play a positive role in choosing the job and in the resulting match between them. Thus they can fittingly supplement the previous more specific characteristics, and considerably extend the overall use of occupational skills profiles. The characteristics of both dimensions are expressed as an index with values ranging from 0 to 100, showing the strength of the given profile or orientation, and they can be aggregated at levels such as the group of occupations, the sector or the whole economy.

2.3.1 Dimension VI – Occupational Interests

This dimension is based on the theory of careers and vocational choice formulated by John L. Holland (1973 and 1999). According to it, preferences for work environment are related to six distinct personality types which can be used to describe both persons and work environment: *Realistic, Investigative, Artistic, Social, Enterprising,* and *Conventional* (usually referred to by their first letters: R-I-A-S-E-C). Any person could be described as having interests associated with each of the six types in a descending order of preference; this assumption allows Holland codes to be used to describe 720 different personality patterns. As also description of jobs and occupations is treated in the same way, that is how it corresponds with each of the six types, the Holland model has been adopted by the U.S. Department of Labor

for categorizing jobs and occupations relative to interests, and has also become an important component in a comprehensive online job search system O*NET.

Describing all occupations in terms of the six personality types allowed to analyse the relationship among individual types not only of persons (job holders) but also of occupations (TABLE 6). It appears that the most opposed are the Realistic and Social types of occupations (Pearson's correlation for 750 individual occupation is –0.63), followed by a pair of Realistic and Enterprising types (–0.58) and then with a little margin Realistic and Artistic types (–0.42) and Conventional and Artistic types (–0.40). Conversely closest pair is made of Social and Artistic types (+0.32).

TABLE 6Relationship between the six personality and work environment (occupation) types

(Pearson Correlation)						
	Realistic	Investigative	Artistic	Social	Enterprising	Conventional
Realistic	1,00	-0,06	-0,42	**-0,63**	**-0,58**	-0,15
Investigative		1,00	0,20	0,08	-0,30	-0,11
Artistic			1,00	0,32	0,05	-0,40
Social				1,00	0,29	-0,19
Enterprising					1,00	0,27
Conventional						1,00

In 2008 among all 750 occupations the highest average index value was acquired by Realistic type occupations (index is 65) that are also the most clean-cut, which means for example more than a quarter of occupations reaches Realistic type in the maximum value of index 100. Conventional type occupations are following with a distance. Conversely Artistic type occupations have the significantly lowest value.

BOX 16 defines the six personality and work environment (occupation) types. As each person, also each occupation can contain characteristics of more than one type, although one type usually prevails or even dominates and defines the occupation from the point-of-view of occupational interests.

BOX 16 Six personality and work environment (occupation) types

Realistic (practical, physical, hands-on, tool-oriented) occupations frequently involve work activities that include practical, hands-on problems and solutions. They often deal with plants, animals, and real-world materials like wood, tools, and machinery. Many of the occupations require working outside, and do not involve a lot of paperwork or working closely with others. Accordingly, the holders of realistic occupations like to work with animals, tools, or machines; generally avoid social activities like teaching, healing, and informing others; have good skills in working with tools, mechanical or electrical drawings, machines, or plants and animals; value practical things you can see, touch, and use like plants and animals, tools, equipment, or machines; and see themselves as practical, mechanical, and realistic.

Investigative (analytical, intellectual, scientific, explorative) occupations frequently involve working with ideas, and require an extensive amount of thinking. These occupations can involve searching for facts and figuring out problems mentally. Accordingly, the holders of investigative occupation like to study and solve math or science problems; generally avoid leading, selling, or persuading people; are good at understanding and solving science and math problems; value science; and see themselves as precise, scientific, and intellectual.

Artistic (creative, original, independent, chaotic) occupations frequently involve working with forms, designs and patterns. They often require self-expression and the work can be done without following a clear set of rules. Accordingly, the holders of artistic occupation like to do creative activities like art, drama, crafts, dance, music, or creative writing; generally avoid highly ordered or repetitive activities; have good artistic abilities in creative writing, drama, crafts, music, or art; value the creative arts like drama, music, art, or the works of creative writers; and see themselves as expressive, original, and independent.

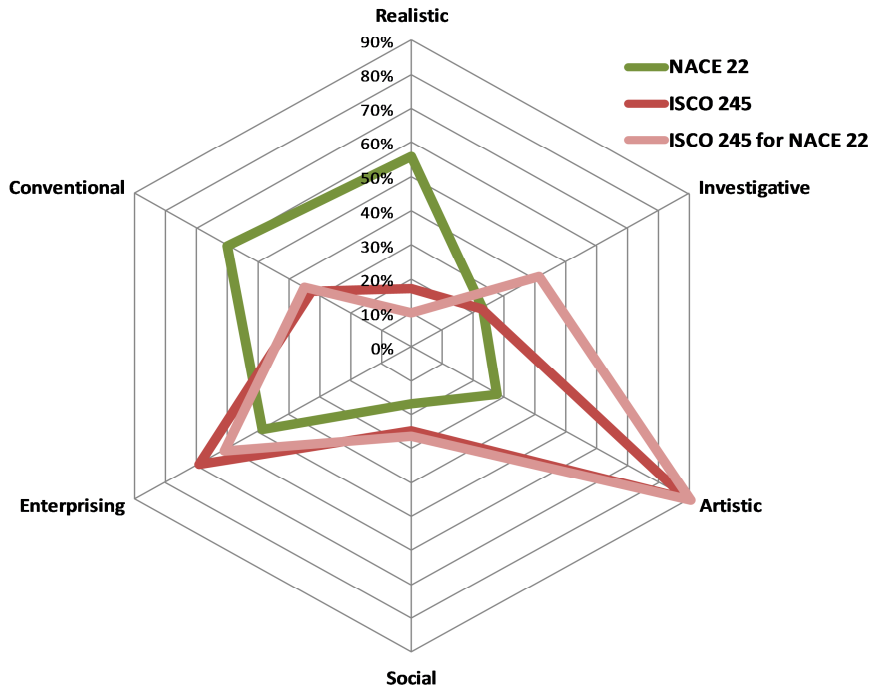
Social (cooperative, supporting, helping, healing/nurturing) occupations frequently involve working with, communicating with, and teaching people. These occupations often involve helping or providing service to others. Accordingly, the holders of social occupations like to do things to help people like, teaching, nursing, or giving first aid, providing information; generally avoid using machines, tools, or animals to achieve a goal; are good at teaching, counseling, nursing, or giving information; value helping people and solving social problems; and see themselves as helpful, friendly, and trustworthy.

Enterprising (competitive environments, leadership, persuading) occupations frequently involve starting up and carrying out projects. These occupations can involve leading people and making many decisions. Sometimes they require risk taking and often deal with business. Accordingly, the holders of enterprising occupations like to lead and persuade people, and to sell things and ideas; generally avoid activities that require careful observation and scientific, analytical thinking; are good at leading people and selling things or ideas; value success in politics, leadership, or business; and see themselves as energetic, ambitious, and sociable.

Conventional (detail-oriented, organizing, clerical) occupations frequently involve following set procedures and routines. These occupations can include working with data and details more than with ideas. Usually there is a clear line of authority to follow. Accordingly, the holders of conventional occupations like to work with numbers, records, or machines in a set, orderly way and generally avoid ambiguous, unstructured activities; are good at working with written records and numbers in a systematic, orderly way; value success in business; and see themselves as orderly, and good at following a set plan.

FIGURE 8 illustrates an example of determining this dimension.

FIGURE 8 Dimension VI – Occupational Interests



2.3.2 Dimension VII – Work Values

Going beyond the domain of Occupational Interests, the dimension Work Values – based on the theory of work adjustment (Davies and Lofquist 1984) – characterises another aspect of the relationship between the job and the job holder that can also considerably affect the "fit" of an individual to a particular occupation. It involves an individual's evaluation of the importance of work activities, of the nature of the work (e.g., authority, creativity), and of conditions of the work environment (e.g., compensation, advancement potential). In order to achieve a good "fit" (that is both a satisfactory performance and job satisfaction), preferences and expectations of an individual, his/her *needs*, should match corresponding stimulus conditions associated with the maintenance of work behavior, called *reinforcers* (Smith and Campbell 2006).

For each O*NET occupational unit its need profile has been derived from job analysts´ ratings of the degree to which the occupational unit in question reinforces (i.e. provides employees with) each of the twenty-one defined needs. Further, six distinct meaningful values have been identified from need reinforcers through strategies of dimensional analyses, and finally the resulting Occupational Reinforcer Patterns (McCloy et al. 1999) have been formed. Also two identical assessment instruments for job holders (Work Importance Profiler for computerised administration and scoring, and Work Importance Locator for card sort administration and scoring), directly linked to O*NET, have been developed by the US Department of Labor.

The six Work Values can be modelled as three dimensions, where each dimension includes polar opposite work values. The three pairs of polar opposites (Rounds 1981) are: *Relationships* versus *Recognition*, *Independence* versus *Support*, and *Achievement* versus

Working Conditions. It is thus possible to represent this dimension, Work Values, in a similar way as the preceding dimension, Occupational Interests.

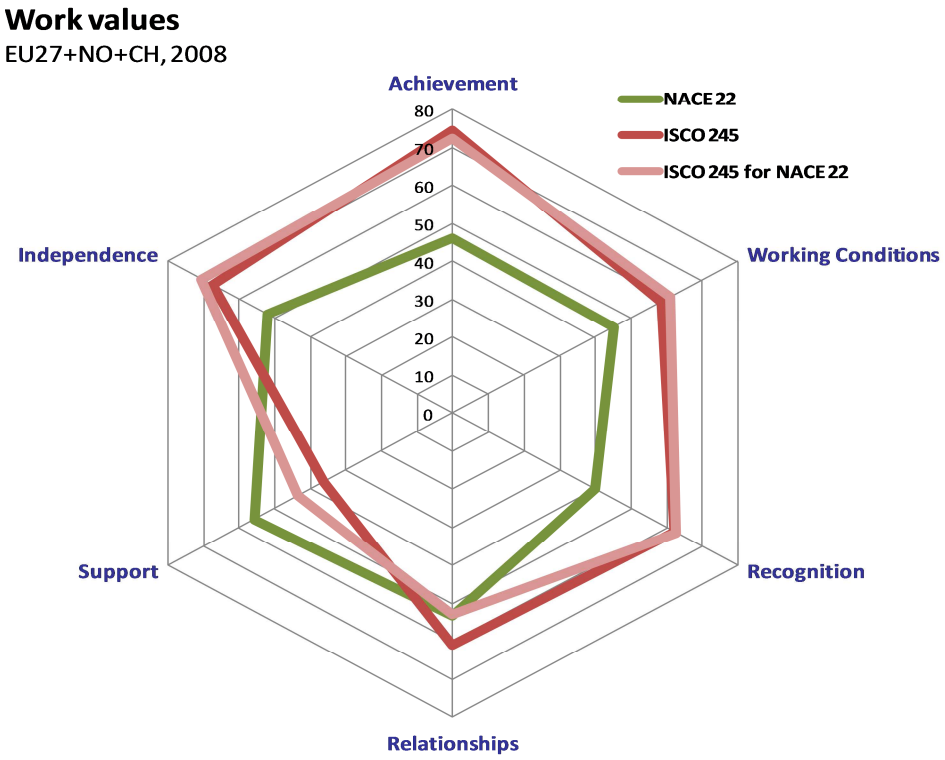
BOX 17 summarises six Work Values and twenty-one Need Reinforcers together with their defining statements.

BOX 17 Work value: Need reinforcer and associated statements

Achievement:	Occupations that satisfy this work value are results oriented and allow employees to use their strongest abilities, giving them a feeling of accomplishment
Ability utilization	Workers on this job make use of their individual abilities
Achievement	Workers on this job get a feeling of accomplishment
Working conditions:	Occupations that satisfy this work value offer job security and good working conditions
Activity	Workers on this job are busy all the time
Independence	Workers on this job do their work alone
Variety	Workers on this job have something different to do every day
Compensation	Workers on this job are paid well in comparison with other workers
Security	Workers on this job have steady employment
Working conditions	Workers on this job have good working conditions
Recognition:	Occupations that satisfy this work value offer advancement, potential for leadership, and are often considered prestigious
Advancement	Workers on this job have opportunities for advancement
Recognition	Workers on this job receive recognition for the work they do
Authority	Workers on this job give directions and instructions to others
Social status	Workers on this job are looked up to by others in their company and their community
Relationships:	Occupations that satisfy this work value allow employees to provide services to others and work with co-workers in a friendly non-competitive environment.
Co-workers	Workers on this job have co-workers who are easy to get along with
Social service	Workers on this job have work where they do things for other people
Moral values	Workers on this job are never pressured to do things that go against their sense of right and wrong
Support:	Occupations that satisfy this work value offer supportive management that stands behind employees.
Company policies	Workers on this job are treated fairly by the company
Supervision human relations	Workers on this job have supervisors who back up their workers with management
Supervision technical	Workers on this job have supervisors who train their workers well
Independence:	Occupations that satisfy this work value allow employees to work on their own and make decisions
Creativity	Workers on this job try out their own ideas
Responsibility	Workers on this job make decisions on their own
Autonomy	Workers on this job plan their work with little supervision

FIGURE 9 illustrates an example of determining this dimension.

FIGURE 9 Dimension VII – Work Values



3. Problems of Transposition and Aggregation

This chapter tries to explain the described complicated methodological process of transposition and aggregation by using a specific example that illustrates and justifies both propositions of the EPC approach: first, that it is necessary to determine occupational skills profiles at the lowest possible level, preferably of individual occupations (as defined by the SOC), and second, that their aggregation at the occupational group level has to be sector-specific (using occupational weighting in order to maintain the specificity of individual occupations). It shows how different results can be arrived at for the respective dimensions of occupational skills profiles. More details (with some mathematics formulas) can be found in the Annex A.1.

The sector NACE 22 *Publishing, printing & reproduction of recorded media* (see BOX 18) and the occupational group ISCO 245 *Writers and creative or performing artists* (one of the most important groups of occupations within the sector – also see BOX 17) have been chosen for the illustration, because they have been analysed in the first EPC full sector review.

BOX 18

NACE 22 *Publishing, printing & reproduction of recorded media* has been defined by NACE (rev 1.1) to include the following three clusters of activities: 22.1 Publishing, 22.2 Printing, 22.3 Reproduction of recorded media. This sector includes units engaged in the publishing of newspapers, magazines, other periodicals, and books. In general, these units, which are known as publishers, issue copies of works for which they usually possess copyright. Works may be in one or more formats including traditional print form and electronic form. The printing activities print such products, and perform support activities, such as bookbinding, plate-making services, and data imaging. The support activities included here are an integral part of the printing industry, and a product that is an integral part of the printing industry is almost always provided by these operations. Though printing and publishing can be carried out by the same unit (a newspaper, for example), it is less and less the case that these distinct activities are carried out in the same physical location.

ISCO 245 *Writers and creative or performing artists* conceive and create or perform literary, dramatic, musical and other works of art (International Standard Classification of Occupations. ILO, Geneve 1988). Tasks performed usually include: writing literary works; appraising merits of literary and other works of art; collecting information about current affairs and writing about them; sculpting, painting, engraving, or creating cartoons; restoring paintings; composing music; dancing or acting in dramatic productions or directing such productions. Supervision of other workers may be included. Occupations in this minor group are classified into the following unit groups (ISCO 4-digit): 2451 Authors, journalists and other writers, 2452 Sculptors, painters and related artists, 2453 Composers, musicians and singers, 2454 Choreographers and dancers, 2455 Film, stage and related actors and directors.

In this example, the composition of the unit group of occupations ISCO 2451 *Authors, journalists and other writers* is discussed. Although it is the lowest ISCO level possible, it still contains such different occupations as *Author, Copywriter, Advertising, Critic, Editor, Journalist, Writer and Technical writer*, whose occupational skills profiles are quite different. If we go up to higher levels of classification, as for instance to the ISCO 3-digit level, far more different occupations are mixed together. The minor group of occupations ISCO 245 includes besides ISCO 2451 also other unit groups of occupations as ISCO 2452, ISCO 2453,

ISCO 2454 and ISCO 2455, that are for example *sculptors, painters and related artists, composers, musicians and singers, choreographers and dancers, film, stage and related actors and directors*. This conclusion is, of course, particularly true for still higher levels of aggregation, for the 2-digit level of the sub-major group of occupations 24 and even more for the 1-digit level of the major group of occupations 2.

As all the three problems – of aggregation, transposition and disaggregation – are intertwined, it is necessary to explain in detail how to:

- link together the international and US classifications of sectors/industries (NACE, used by the Eurostat for European countries, and NAIRIC, used in the USA),
- similarly link classifications for occupations (ISCO and SOC),
- use their linkage for comparing European and US projections.

Under the occupational group ISCO 245 it is possible to classify 16 individual occupations as defined by the US SOC (indicated in the twin-table below). And in the same way it is possible to aggregate 4 relevant individual industries as defined at the fourth NAIRIC level into the sector NACE 22. (If, for instance, instead of O*NET /SOC the Italian classification – developed as a part of the project *Indagine sulle professioni* – be used, 19 occupations would be classified from more than 800 occupations, should the far more detailed Czech classification *KZAM* – established in 1991 by adopting all four levels of the ISCO 88 and extending it by the fifth national level – be used, 62 occupations of about 3500 occupational units would be classified. It is obvious that the size of about one thousand of occupational units suffices for disaggregating occupational groups defined at a higher level.)

3.1 Transposition of US data to European classifications

TABLE 7 illustrates the first stage of the process. US data have been transposed by using two correspondence tables, NACE to NAIRIC, and ISCO to SOC. The twin-table shows, first, the employment in the US economy in 2006 for all SOC occupations which map into ISCO 245, and at the same time are under those NAIRIC individual industries which are aggregated to NACE 22. Reading the table horizontally, total employment (taken from the US data) is indicated for each occupation, followed by the number of jobs in the respective NAIRIC individual industry, the last column to the right (that is the sum of the previous four columns) indicates the result transposed to the international classification – the sector NACE 22. The same process is applied vertically: again, the first row indicates total employment, further sixteen rows indicate the position of respective occupations; the last row, the sum of all jobs in respective SOC occupations and NAIRIC individual industries, is already transposed to the occupational group ISCO 245, while the final total sum (the last column to the right) is transposed both to ISCO 245 and to NACE 22. The second part of the twin table repeats the exercise for the projection for 2016.

TABLE 7 illustrates a very uneven distribution of individual occupations in different sectors. Those employed in occupations more or less akin to art and literature represent more than 70 % of all jobs in the occupational group ISCO 245 across sectors, in the whole economy, whereas *Reporters and Correspondents* and *Editors* represent less than 18 % of jobs in this occupational group. The latter, on the contrary, represent in the sector *Publishing, printing & reproduction of recorded media* (NACE 22) more than 80 % of jobs in the whole occupational group ISCO 245, whereas the former represent less than 15 % (mostly *Writers and Authors*).

An uneven distribution of occupations persists in the ten-year projection. According to it, for example, the total employment in US economy will increase by more than 10 % in the period 2006-2016 but the employment in the sector NACE 22 will decrease by almost 15 %. Most occupations in the occupational group ISCO 245 will grow taken across sectors, in the whole economy, but fall in the sector NACE 22. This is also why the number of jobs in occupations such as *Writers, Technical Writers, Authors, Music Directors and Composers* is expected to increase rapidly, while the number of jobs in occupations *Reporters and Correspondents* and *Editors* will stagnate.

The table is, in fact, only part of a large matrix based on US data and containing 352 industries defined at the 4th NAIRIC level by 826 individual occupations defined by SOC (out of more than 290 thousand cells of the matrix many will be empty, of course). The large matrix is then transposed into international classifications (used by EUROSTAT) and, at the same time, aggregated into a smaller matrix containing 38 NACE sectors used in European projections at this moment and 106 occupational groups at the ISCO 3-digit level, which can always find its counterpart in several SOC individual occupations. The "European" matrix contains thus over 4 thousand cells, about 60 % of them have more than 50 jobs, further 3 % of them have less than 50 jobs, about 37 % have no jobs at all (zero cells). All non-zero cells that represent at least some jobs in Europe have their qualification profiles determined for a sector-specific group of occupations. In principle, there should be one for each non-zero cell, and as their proportion is 60 %, this would make almost 3000 non-zero cells. In practice we will establish an occupational skills profile only for those cells where the number of jobs (employment) is at least 0,01 % of the total jobs/employed in Europe (EU 27 + Norway + Switzerland) that is more than 23,5 thousand jobs/employed.

TABLE 7 Transposition of US data to European classifications

Jobs / Employment in US Economy 2006 by industries and by occupation for sector NACE 22 and group of occupations ISCO 245 (Employment Projection 2006-2016. US BLS 2007)		Total employment, all workers	Printing and related support activities	Manufacturing and reproducing magnetic and optical media	Newspaper, periodical, book, and directory publishers	Sound recording industries	Publishing, printing & reproduction of recorded media
SOC code 2006	NAIRIC	Total	3231	3346	5111	5122	NACE 22
00-0000	Total, all occupations, USA 2006	150 620 175	635 900	41 100	660 300	20 300	1 357 600
27-1011	Art Directors	77 898	1 234		5 450	71	6 754
27-1012	Craft Artists	8 816					<50
27-1013	Fine Artists, Including Painters, Sculptors, and Illus	30 323			1 174		1 174
27-1019	Artists and Related Workers, All Other	13 799					<50
27-2011	Actors	70 030				65	65
27-2012	Producers and directors	93 074			334	628	962
27-2031	Dancers	19 767					<50
27-2032	Choreographers	20 429					<50
27-2041	Music Directors and Composers	68 005				289	289
27-2042	Musicians and Singers	196 330					<50
27-3021	Broadcast News Analysts	7 724			314		314
27-3022	Reporters and Correspondents	59 212			39 216		39 216
27-3041	Editors	121 511	463	52	59 414	294	60 222
27-3042	Technical Writers	49 151	74	160	2 628		2 862
27-3043	Writers and Authors	135 246			8 206	176	8 382
27-3099	Media and Communication Workers, All Other	35 660	112			92	204
ISCO 245	Writers and creative or performing artists	1 006 974	1 882	212	116 736	1 614	120 443

Jobs / Employment in US Economy 2016 by industries and by occupation for sector NACE 22 and group of occupations ISCO 245 (Employment Projection 2006-2016. US BLS 2007)		Total employment, all workers	Printing and related support activities	Manufacturing and reproducing magnetic and optical media	Newspaper, periodical, book, and directory publishers	Sound recording industries	Publishing, printing & reproduction of recorded media
SOC code 2016	NAIRIC	Total	3231	3346	5111	5122	NACE 22
00-0000	Total, all occupations, USA 2016	166 220 300	497 400	39 600	610 900	17 800	1 165 700
27-1011	Art Directors	84 670	977		5 296	63	6 336
27-1012	Craft Artists	9 522					<50
27-1013	Fine Artists, Including Painters, Sculptors, and Illus	33 337			1 088		1 088
27-1019	Artists and Related Workers, All Other	14 955					<50
27-2011	Actors	78 141				56	56
27-2012	Producers and directors	103 360			328	556	884
27-2031	Dancers	21 643					<50
27-2032	Choreographers	20 927					<50
27-2041	Music Directors and Composers	76 763				256	256
27-2042	Musicians and Singers	216 172					<50
27-3021	Broadcast News Analysts	8 184			272		272
27-3022	Reporters and Correspondents	59 921			38 051		38 051
27-3041	Editors	124 275	367	51	52 806	260	53 483
27-3042	Technical Writers	58 741	59	157	2 601		2 817
27-3043	Writers and Authors	152 552			7 559	153	7 712
27-3099	Media and Communication Workers, All Other	39 848	89			82	170
ISCO 245	Writers and creative or performing artists	1 103 211	1 491	208	108 002	1 425	111 126

Note 1: For statistical reasons the table does not contain data for cells containing fewer than 50 cases.

Note 2: Five occupations have no or very low employment (less than 50) in the sector NACE 22 (although they are quite numerous in other sectors) and are not included in the employment of the sector NACE 22. Respective cells are coloured in grey.

It is necessary to be aware of two things. On one side, it is the wealth of information contained in the large matrix based on US classifications NAIRIC and SOC, and also a great difference in data availability between the USA and Europe. As there exist no corresponding detailed data for Europe, the above table would have been only limited to four overall values indicated in the four corners of the table. Luckily enough, due to the two correspondence tables provided by the EPC, it has been possible to use the US detailed data and classifications also for Europe. On the other side, however, there exists a certain caveat. This approach is limited to a strictly specified objective, to determine sector-specific occupational

skills profiles, and it is not possible to transfer the inner, US based contents of the table neither to various countries nor over time.

To sum up the approach in different words, a qualification profile for any ISCO 3-digit occupational group represented in a given NACE sector is prepared by using knowledge about how individual occupations (classified by the SOC and described by the O*NET) are represented in those NAIRIC individual industries which correspond to a given NACE sector.

3.2 Constructing a sector-specific profile

TABLE 8 shows the second stage of the process: how a sector-specific occupational skills profile has been arrived at. As already stated, a relatively narrow occupational group ISCO 245 and the sector NACE 22 serve as an example. Moreover, the table also illustrates how different results have been obtained for the seven dimensions of occupational skills profiles.

To begin with, let us compare the occupational skills profile of the occupational group ISCO 24 *Other Professional* with those of ISCO 245 *Writers and creative or performing artists* (which is a part of ISCO 24) and of concrete SOC occupations included in ISCO 245 (the table indicates four examples of them). It is quite understandable that their respective occupational skills profiles differ a lot, as ISCO 245 jobs represent only about 15 % of all ISCO 24 jobs. Due to other large groups (for instance ISCO 241 *Business professionals*, ISCO 242 *Legal professionals* or ISCO 244 *Social science and related professionals*), the whole occupational group ISCO 24 requires a higher level of formal qualification, with a strong role for economics and law, which is quite different from ISCO 245.

Similar marked differences also exist between the occupational group ISCO 245 and individual occupations contained in it. Some occupations are quite demanding in terms of qualification requirements (*Reporters and Correspondents*), some only moderately (*Actors*). Some occupations require education in art (*Actors*), some in humanities or social sciences (*Producers and directors*). At higher levels of aggregation, however, the values are closer to the average or tilted towards predominant occupational groups. Any marked individual differences at the detailed occupational level get suppressed.

Moreover, the representation of individual occupations across sectors differs a lot as well. For instance, *Reporters and Correspondents (*and the corresponding ISCO occupation *Journalists)* represent only about 6 % of ISCO 245 jobs taken across all sectors, but one third of all jobs of the sector NACE 22 *Publishing, printing and reproduction of recorded media*, as two third of journalists work within this sector. On the contrary, *Actors* representing almost 8 % of ISCO 245 jobs (taken across all sectors) are almost non-existent in the sector NACE 22. Whereas the impact of *Reporters and Correspondents* on the ISCO 245 profile is significant, the one of actors is nil.

The occupation *Reporters and Correspondents* has a rather different occupational skills profile compared to other occupations of the ISCO 245 occupational group in the sector NACE 22. From the point-of-view of the level of qualification requirements, the 7^{th} level of qualification requirements (that of a master's degree) prevails, while it is the 6^{th} level (that of a bachelor's degree) that prevails otherwise across the occupational group. Similar differences can be observed as regards fields of education/training. Whereas in the occupation *Reporters and Correspondents* mostly graduates in social, media and cultural studies are sought-after, in the occupational group ISCO 245 it is the graduates in art studies that are required. Similarly,

it is possible to find great differences when comparing other dimensions of occupational skills profiles.

As for the first proposition, the table shows that the results concerning dimensions of an occupational skills profile depend largely on the level of detail at which they have been determined. Three levels have been considered: besides the ISCO 2-digit and the ISCO 3-digit levels (with 27 and 106 occupations respectively) also the more detailed level of individual occupations. In the left part of the table very different outcomes are indicated: for the occupational group ISCO 24, for the occupational group ISCO 245, and finally for four individual occupations which all would come under the occupational group 245 – *Actors, Art directors, Producers and directors, Reporters* and *Correspondents* (these four occupations have been selected out of the 16 SOC occupations which come under ISCO 245 according to the correspondence table).

As for the second proposition, the sector-specific way of aggregation is illustrated using the example of the sector NACE 22 *Publishing, printing and reproduction of recorded media* (which was the first one that the EPC analysed). The difference in results is clearly shown by comparing the columns headed ISCO 24 and ISCO 245 (those on the left are based on results for all sectors added together, whereas those on the right are sector-specific, based on the observed jobs weights for NACE 22, reflecting actual jobs shares as classified by the SOC and transposed to the ISCO 3-digit by using the EPC correspondence table).

TABLE 8 An example of a sector-specific profile

Occupational Skills Profile - OSP			Group of occupation		Individual occupation (SOC & ISCO 245)				NACE 22 specific	
OSP dimensions		OSP characteristics	ISCO 24	ISCO 245	Actors	Art directors	Producers & Directors	Reporters & Corresp.	ISCO 245	ISCO 24
Level of Qualification Requirements		Low	0%	1%	4%	0%	0%	0%	0%	0%
		Meduim	13%	19%	55%	54%	24%	3%	9%	9%
		High	86%	80%	41%	46%	76%	97%	91%	90%
		Average Years of Education	**15,4**	**15,2**	**13,5**	**13,8**	**15,0**	**15,9**	**15,6**	**15,6**
Field of Education / Training		General/ no specific field	5%	8%	5%	6%	10%	11%	9%	9%
		Art, fine/ applied	4%	36%	78%	48%	23%	4%	16%	13%
		Humanities	8%	14%	5%	2%	10%	21%	24%	20%
		Technical and engineering	10%	9%	1%	28%	13%	4%	7%	8%
		Agriculture/ forestry	2%	1%	0%	0%	0%	5%	1%	2%
		Teacher training/ education	3%	4%	1%	3%	3%	4%	5%	4%
		Science/ mathematics/ computing etc	4%	1%	0%	0%	1%	2%	2%	2%
		Medical/ health services/ nursing etc	3%	2%	0%	0%	0%	2%	2%	2%
		Economics/ business/ administration	40%	5%	0%	6%	14%	6%	5%	14%
		Social studies/ media/ culture	11%	17%	10%	6%	22%	36%	24%	22%
		Law and legal services	9%	1%	0%	0%	1%	2%	2%	2%
		Personal care services	1%	1%	0%	2%	2%	1%	1%	1%
		Public order and safety	0%	0%	0%	0%	0%	1%	1%	1%
		Transport and telecommunications	1%	1%	0%	0%	1%	1%	1%	1%
Knowledge	Level	Education and Training	44%	51%	37%	61%	44%	44%	46%	46%
		Arts and Humanities	35%	53%	55%	53%	45%	49%	52%	48%
		Social sciences, Economy and Law	42%	35%	35%	22%	34%	35%	33%	34%
		Sciences, Mathematics and Computers	27%	25%	12%	20%	24%	27%	27%	28%
		Engineering, Technology, Production an	29%	28%	13%	42%	33%	23%	26%	27%
		Helath services	18%	15%	16%	9%	8%	12%	12%	12%
		Services	37%	34%	17%	33%	42%	36%	34%	34%
		Bussiness and Management	50%	44%	24%	44%	49%	39%	41%	43%
	Importance	Education and Training	40%	46%	34%	43%	37%	36%	42%	41%
		Arts and Humanities	39%	59%	60%	56%	51%	57%	59%	55%
		Social sciences, Economy and Law	45%	34%	42%	21%	34%	32%	30%	32%
		Sciences, Mathematics and Computers	26%	21%	9%	16%	22%	22%	22%	23%
		Engineering, Technology, Production an	30%	29%	15%	42%	35%	22%	27%	28%
		Helath services	18%	13%	10%	7%	6%	11%	11%	11%
		Services	40%	37%	22%	36%	47%	38%	36%	36%
		Bussiness and Management	50%	43%	24%	50%	53%	37%	38%	41%
Skills	Level	Cognitive skills	60%	60%	45%	54%	57%	54%	56%	56%
		Communication in the mother language	39%	40%	23%	38%	46%	35%	35%	35%
		Comunication in foreign languages	63%	70%	52%	49%	54%	59%	55%	54%
		Numeracy & basic SMT concepts	17%	16%	9%	8%	15%	11%	18%	17%
		ICT/digital	43%	32%	6%	39%	37%	27%	32%	34%
		Learning to learn	13%	9%	1%	3%	20%	10%	7%	9%
		Practical skills	52%	64%	63%	61%	59%	52%	54%	53%
	Importance	Cognitive skills	70%	68%	53%	65%	69%	64%	64%	65%
		Communication in the mother language	47%	47%	29%	46%	54%	44%	44%	44%
		Comunication in foreign languages	78%	82%	73%	76%	81%	86%	80%	79%
		Numeracy & basic SMT concepts	16%	17%	8%	10%	17%	11%	17%	17%
		ICT/digital	46%	30%	5%	41%	37%	25%	30%	33%
		Learning to learn	13%	11%	1%	4%	19%	10%	10%	11%
		Practical skills	52%	63%	70%	61%	56%	46%	49%	49%
Competence		Personal abilities	73%	77%	80%	77%	80%	76%	76%	75%
		Social abilities	57%	59%	64%	65%	65%	57%	56%	56%
		Methodological abilities	56%	56%	49%	61%	71%	53%	56%	56%
Occupational Interests		Realistic	14%	17%	28%	33%	18%	11%	10%	11%
		Investigative	40%	23%	6%	6%	9%	50%	29%	30%
		Artistic	27%	89%	95%	100%	70%	89%	90%	76%
		Social	41%	25%	33%	22%	31%	28%	21%	22%
		Enterprising	69%	69%	61%	89%	98%	56%	73%	73%
		Conventional	67%	32%	11%	33%	48%	33%	42%	49%
Work Values		Achievement	68%	74%	78%	83%	76%	78%	74%	73%
		Working Conditions	63%	59%	53%	81%	69%	58%	58%	59%
		Recognition	61%	63%	61%	67%	77%	72%	67%	66%
		Relationships	68%	57%	83%	45%	69%	39%	48%	52%
		Support	56%	37%	17%	39%	42%	39%	45%	47%
		Independence	69%	70%	61%	89%	81%	67%	77%	75%

Note 1: The characteristics of the first two dimensions – Level of Qualification Requirements and Field of Education/Training – indicate a relative, percentage distribution of jobs (the sum of the respective column – for all 8 EQF levels or for all 14 fields of education – makes 100 %). The characteristics of the remaining five dimensions – Knowledge, Skills, Competence, Occupational Interests, and Work Values – indicate the required level of the characteristics in question. Although in the O*NET data set the characteristics were expressed by different scales (e.g. 0-6, 0-5, 1-7 etc.), they have been converted to percentage values 0 % - 100 % for their presentation, to make them more understandable and, in particular, comparable.

Note 2: The column "Group of occupation" covers all sectors.

Note 3: As for the column "Individual occupation (SOC)", we have to remember that O*NET defines characteristics for individual occupations regardless of the sector.

4. Presentation of outcomes

In the core project the Cambridge Econometrics use the E3ME model whose structure of sectors is based on the classification NACE Rev.1.1. The number of sectors has been reduced by different aggregations to 41. The EPC use the same classification, however the number of sector has been further reduced to 38, as three pairs of sectors had to be united due to data limitations. The first united sector puts together sectors Pharmaceuticals (10 – number of sector in E3ME sector classification) and Chemicals (11), the second one sectors Electricity (22) and Gas Supply (23), and the third one sectors Professional Services (36) and Other Business Services (37).

Occupational Skills Profiles are computed for each of the 38 sectors and the economy as a whole and for each of the 29 EU countries as well as for the EU29 as a whole.

These results are presented in Country Workbooks. Each of them contains 71 columns (corresponding to the detailed structuring of dimensions mentioned above) and 117 rows as 39 sectors (38 sectors mentioned above + the economy as a whole) in 3 years 2000, 2008 and 2020 are covered. Overall the table contains more than 8,300 cells.

Next tables show an example of change in the 7 dimensions expected from 2000 to 2020 as computed for the EU29.

4.1 Level of Qualification Requirements.

EU 29		Number of jobs (in thousand)		% of total		Change 2000-2020	
		2000	2020	2000	2020	Number	Share of Total
Required Education Level	Low	82 949	84 946	38,21%	36,23%	1 998	-1,98
	Medium	85 769	89 866	39,50%	38,33%	4 097	-1,18
	High	48 396	59 670	22,29%	25,45%	11 274	3,16
	Total	217 114	234 482	11,36	11,57	17 368	0,21
				Average years of education			

An increase by 0.21 years is expected for the Average years of education required for jobs.

4.2 Field of Study

EU29		Number of jobs (in thousand)		% of total		Change 2000-2020	
		2000	2020	2000	2020	Number	Share of total
Field of Education	General/no specific field	43 455	45 588	20,13%	19,54%	2 134	-0,59
	Art, fine/applied	2 591	2 983	1,20%	1,28%	392	0,08
	Humanities	2 601	3 144	1,20%	1,35%	543	0,14
	Technical and engineering	69 559	70 771	32,22%	30,34%	1 212	-1,88
	Agriculture/forestry	10 016	7 628	4,64%	3,27%	-2 388	-1,37
	Teacher training/ education	10 883	11 991	5,04%	5,14%	1 108	0,10
	Science/mathematics/ computing etc	4 191	5 363	1,94%	2,30%	1 172	0,36
	Medical/health services/ nursing etc	14 172	16 843	6,56%	7,22%	2 671	0,65
	Economics/commerce/business administration	35 557	40 894	16,47%	17,53%	5 337	1,06
	Social studies/administration/media/culture	4 518	6 164	2,09%	2,64%	1 645	0,55
	Law and legal services	2 101	2 985	0,97%	1,28%	884	0,31
	Personal care services	12 556	14 938	5,82%	6,40%	2 382	0,59
	Public order and safety	1 396	1 578	0,65%	0,68%	182	0,03
	Transport and telecommunications	2 287	2 422	1,06%	1,04%	135	-0,02

The highest growth is expected for jobs where the required Field of Study is *Economics, commerce, business administration*. On the other hand, jobs where the required Field of Study is *Agriculture/forestry* should decline the most. Although their absolute number will increase, the share of total job will decrease the most for jobs, where the required Field of Study is *Technical and engineering*.

4.3 Knowledge

EU 29			2000	2020	2000-2020 (p. p.)
Knowledge	Importance	01 Education and Training	40,67%	41,46%	0,79
		02 Arts and Humanities	22,67%	23,11%	0,44
		03 Social sciences, Economy and Law	26,90%	27,79%	0,90
		04 Sciences, Mathematics and Computers	22,32%	22,50%	0,18
		05 Engineering, Technology, Production and Processing	25,75%	25,61%	-0,14
		06 Helath services	15,86%	16,82%	0,96
		07 Services	37,54%	37,85%	0,31
		08 Bussiness and Management	37,33%	37,77%	0,44
	Level	01 Education and Training	41,52%	42,38%	0,86
		02 Arts and Humanities	20,86%	21,34%	0,48
		03 Social sciences, Economy and Law	24,85%	25,70%	0,85
		04 Sciences, Mathematics and Computers	22,01%	22,23%	0,22
		05 Engineering, Technology, Production and Processing	24,45%	24,32%	-0,13
		06 Helath services	14,89%	15,72%	0,84
		07 Services	31,63%	31,95%	0,32
		08 Bussiness and Management	34,29%	34,90%	0,61

The highest increase in Knowledge is expected in *Health services*.

4.4 Skills

EU 29			2000	2020	2000-2020 (p. p.)
Skills	Importance	01 Cognitive skills	55,31%	55,39%	0,08
		02 Practical skills	34,17%	33,32%	-0,84
		03 Communication in the mother language	59,19%	59,61%	0,42
		04 Comunication in foreign languages	13,76%	14,11%	0,35
		05 Numeracy + basic SMT concepts	30,04%	30,59%	0,56
		06 ICT/digital	9,14%	9,48%	0,33
		07 Learning to learn	37,58%	38,34%	0,76
	Level	01 Cognitive skills	45,71%	45,96%	0,25
		02 Practical skills	27,70%	27,28%	-0,42
		03 Communication in the mother language	46,59%	46,95%	0,36
		04 Comunication in foreign languages	12,02%	12,47%	0,45
		05 Numeracy + basic SMT concepts	26,61%	27,15%	0,54
		06 ICT/digital	7,68%	8,05%	0,37
		07 Learning to learn	35,50%	36,24%	0,74

As for Skills, the importance and level of *Learning to learn* will increase the most.

4.5 Competence

EU 29			2000	2020	2000-2020 (p. p.)
Competence	Importance	01 Personal abilities	65,54%	65,60%	0,05
		02 Social abilities	50,55%	51,07%	0,52
		03 Methodical abilities	47,71%	47,85%	0,13
	Level	01 Personal abilities	42,29%	42,50%	0,22
		02 Social abilities	41,84%	42,29%	0,45
		03 Methodical abilities	35,83%	36,26%	0,43

As for Competence, the importance and level of *Social abilities* will increase the most.

4.6 Occupational Interests

EU 29		2000	2020	2000-2020 (p. p.)
Occupational Interests	Artistic	14,46%	14,12%	-0,34
	Conventional	59,16%	59,04%	-0,12
	Enterprising	45,59%	47,41%	1,81
	Investigative	25,91%	26,32%	0,41
	Realistic	62,11%	59,28%	-2,83
	Social	30,46%	33,04%	2,58

As for Occupational Interests, the importance of the personality type *Social* will increase the most.

4.7 Working Values

EU 29		2000	2020	2000-2020 (p. p.)
Work Values	Achievement	15,02%	15,62%	0,60
	Independence	17,01%	17,46%	0,45
	Recognition	12,45%	12,97%	0,52
	Relationships	21,03%	21,50%	0,47
	Support	20,25%	20,23%	-0,03
	Working Conditions	15,38%	15,64%	0,25

As for Working Values, the importance of *Achievement* will be the most growing one.

5. Summary

5.1 Aims

- To develop a new Module focusing on implications for generic skills.
- To develop „static" Occupational Skills Profiles.
- To focus on likely changes of Occupational Skill Profiles over time, thus developing "dynamic" profiles for 2000, 2010 and 2020.

5.2 Approach and practical lessons for CEDEFOP

- Definition: Occupational Skills Profiles sum up characteristics describing various dimensions of qualification requirements, conditions and qualities needed in a given job.
- Occupational Skills Profiles allow us to identify some sectoral and occupational differences between individual countries.
- The advantage of the EPC approach of Occupational Skills Profiles compared to some other approaches is that skills, knowledge and other characteristics required for each occupation are not only defined, but also measured, so that they can be compared both between sectors and in time.
- Integration of Occupational Skills Profiles into the core project: Occupational Skills Profiles were determined for each of 27 occupations in each of 41 sectors used in the CEDEFOP core projection. Than Occupational Skills Profiles for each country are weighed by CEDEFOP projections in order to compute data contained in Country Workbooks.
- Extension of the core project by Occupational Skills Profiles: Contrary to the core projection, outputs of this task are not focused on the number and qualification of job holders (that is of persons) but on the number of jobs and their requirements. By comparing the outcomes of this Task with the outcomes of the core projection it is possible to compare job's requirements (a demand side of the model) with abilities of people (a supply side of the model). The comparison is proposed for the next year of the project.
- The construction of Occupational Skills Profiles is based on two pillars:
  - Their contents, that is the wealth of available data, is taken mainly from two sources the US O*NET and the European Social Survey;
  - Their structure is basically consistent with the European Qualification Framework.
- Based on the correlation analysis we feel fully justified to use US data for constructing OSPs for European countries.
- An Occupational Skills Profile has 7 dimensions (divided into 66 groups at the most detailed level) forming 3 main groups.

- *Coordinating characteristics* contain the two basic dimensions, the Level of Qualification Required, and the Field of Education/Training Required.
  Level of Qualification Requirements: Its structure with eight levels of work complexity was directly taken from the EQF, where the levels are described by generally applicable descriptors. Its contents was taken mainly from the ESS, but carefully balanced with other sources and approaches, as employee surveys, employer requirements (for example by Eures) and expert analyses. Originally, the eight-level scale as defined by the EQF was used, serving as the vertical axis of the profile. However, in the current set of workbooks the first Dimension has been aggregated into a three-level scale corresponding to the three broad levels (Low, Medium and High) adopted in the Core project.

  Field of Education/Training contains 14 groups of fields of education and training defined according to the International Standard Classification of Education (ISCED).
- *Main characteristics* contain three dimensions based on learning outcomes describing what the worker should really know, understand and be able to do (instead of a traditional focus on educational institutions and certificates).

  Knowledge is structured into eight main areas, further sub-divided into 32 sub- areas. Its structuring is based on the corresponding part of the O*NET model, but adapted to the ISCED structure.

  Skills: Their structuring follows the EQF distinction between cognitive and practical skills, but is more detailed and includes relevant generic skills as defined under Key competencies (such as Communication both in mother and foreign languages, Numeracy and ICT skills, and Learning to learn).

  Competence is defined according to the EQF in terms of responsibility and autonomy, and is further structured into three areas – personal abilities, social abilities, and methodical abilities.
- *Supplementary characteristics* focus on the match between the job and the job holder. Both dimensions are important for choosing the job.

  Occupational Interests: This dimension links preferences for work environment to six distinct personality types. It can be used to describe both persons and work environment.

  The orientation towards Work Values is important both for the satisfaction of the job-holder and for his satisfactory performance.

5.3 Key results

- Occupational Skills Profiles are computed for 29 EU countries as well as for EU29 as a whole.
- These results are presented in Country Workbooks.
- Each of them contains 66 columns (corresponding to the detailed structuring of dimensions mentioned above) and 117 rows (as 39 sectors in 3 years 2000, 2010 and 2020 are covered). Overall the table contains more than 7,700 cells.
- An example of change in the 7 dimensions expected from 2000 to 2020 as computed for EU29:

- An increase by 0.21 years is expected for the Average years of education required for jobs in the Level of Qualification Requirements.
- The highest growth is expected for jobs where the required Field of Study is *Economics, commerce, business administration*. On the other hand, jobs where the required Field of Study is *Agriculture/Forestry* should decline the most.
- The highest increase in Knowledge is expected in *Health services*.
- As for Skills, the importance of *Learning to learn* will increase the most.
- As for Competence, the importance of *Social abilities* will increase the most.
- As for Occupational Interests, the importance of the personality type *Social* will increase the most.
- As for Working Values, the importance of *Achievement* will be the most growing one.

6. Frequently Asked Questions

This chapter presents answers to some important and frequent questions that were raised about previous versions of this document by CEDEFOP and country experts personally during workshops and by e-mails. To similar questions regarding the same subject only one answer is provided.

We hope this chapter will help readers to better understand the OSPs methodology. We are very grateful for all the comments we have already received and will really welcome the new ones concerning this version so that we may respond to them in the final version of the methodology to be prepared in the course of 2012.

***Q**: One of the participants expressed concern whether occupational skills profiles consider the accumulation of skills during individual's lifetime. The EU population is ageing rapidly. The formal qualification acquired by individuals in the initial education and training system is not enough anymore. The knowledge, skills and competences of the people need to be continuously updated. Share of adults who participate in lifelong learning is constantly increasing in Europe. By the age of e.g. 50 individual considerably raises its qualification by adding new or improving existing knowledge, skills and competences. Thus real qualification of individual aged 50 is much higher than formal (initial) one. Question is whether occupational skills profiles developed within this project consider this difference between formal and real qualification levels of individuals, i.e. whether they incorporate adult learning dimension within occupational skills profiles? If not, this dimension should be duly considered in the module as it will become more and more important until 2020. Employer survey on skills needs in Europe developed by Cedefop could provide important additional evidence in this respect.*

***Q**: Another issue raised by participants regarding occupational skills profiles is situation that currently large share of youth has qualification required for a particular type of job, but does not have relevant skills that are needed to perform it. Participants were wondering whether this difference between formal qualification and current level of skills of an individual is considered in occupational skills profiles.*

A: By definition OSPs describe the characteristics of the job, not of the job holder (see Chapter 1.1). On the contrary, both questions concern job holders, and should be addressed instead to core projections which focus on job holders. Moreover, a different question should be posed: To what extent does the level of formal education attained indicate the real qualification?

***Q**: Are skills profiles at the most detailed level (ISCO 2 digits occupations x 38 industries) identical for all European countries? This seems to be the case for dimensions 3 through 7, which are based on an extra-European source, but is this also true for the first two dimensions, for which the ESS is the main input?*

A: Up to the present, all dimensions of OSPs at the level of ISCO 3 digits occupations (about 110-120 groups of occupations) x 38 industries are identical for all European countries**.** At the aggregated level used in the core project (ISCO 2 digits occupations x 38 industries) all dimensions are country specific, as all aggregations of jobs have been performed as country

specific. During the year 2012, however, also OSPs at the level of ISCO 3 digits occupations x 38 industries will be country specific for the 1st and 2nd dimensions as they will be prepared in a different way to be explained in the final version of the methodology.

***Q**: Have these industry x occupation profiles been calculated for one given base year (which?) or for different years? In other words, are the 2000 and 2010 overall industry profiles that are available in the country workbooks to be interpreted as separate observations or do they result from applying a different employment structure (industry x occupation) to once-and-for-all given profiles by industry x occupation?*

***Q**: Are the occupational skill profiles of groups stable and the trends are constructed only on the basis of changing occupational structure of employment?*

A: Yes, but only for dimensions 3 through 7. All industry x occupation profiles have been calculated for the last year available in the O*NET (version 16.0 from July 2011) for all groups of jobs at the level of ISCO 3 digits occupations (about 110-120 groups of occupations) x 38 industries. Profiles for years 2000 and 2020 have been obtained by re-weighting static base-year profiles (industry x occupation) by BLS and CEDEFOP projected employment structure. OSPs of groups are stable, their trends are constructed only on the basis of change in the occupational structure of employment.

The 1st and 2nd dimensions of OSPs for all groups of jobs at the level of ISCO 3 digits occupations (about 110-120 groups of occupations) x 38 industries are dynamic in time. The way how they are calculated is explained in Chapter 2.1.

***Q**: Overall, there seems to be relatively little variation in the industry as well as the aggregate profiles across countries at a given moment of time, and, even more surprisingly, across time for given countries or for Europe as a whole.*

A: Largest variations of OSPs occur understandably at the level of occupations. However, marked variations can be found between industries and countries. For example the same industry requires a high level of education and skills in one country, whereas a considerably lower level in another country. Our preliminary analyses have shown that it may be caused by the orientation and technological level of the country in question. In the automotive industry, for example, the occupational mix and skills requirements in Germany or Sweden are considerably higher than in Italy or the Czech Republic, as they, of course, closely correspond with very different levels of R&D expenditure in the industry. During 2012 more similar detailed analyses will be prepared.

Nevertheless, it is possible that relatively little variations in preceding versions were caused by the fact that intra-occupation changes were not covered. In this version of the methodology the outcomes of analysis/projection take into account the dynamisation of the 1st a 2nd dimensions. For dimensions 3 through 7 the problem is more complicated. The O*NET seems to be a good source for them but it will take much more time to analyse them in time series, as some problems still remain.

***Q**: With regard to the seven dimensions vis-à-vis the industry profile, can you kindly indicate how such individual percentages for each dimension was reached, in particular for each member state? Which were those factors that would create a different percentage scales (for a given dimension and industry) for different member states? Have these percentages been*

calculated for a given base year or for different years? Kindly indicate which were the year(s) under observation.

***Q**: Differences between countries represent different occupational mix in specific sectors (and industries in case of total country results)? The OSP for specific industry-occupation cell are common for all countries?*

A: We hope that both questions have been adequately answered and explained by our answers to the preceding questions.

***Q**: As stated, occupational skills profiles, which summarise essential characteristics for a given occupation, have been developed for, amongst other uses, analysing, projecting and forecasting skill needs, determining education mismatches and comparing differences between European countries. Using data from the USA, such as the occupational information network (O*NET) and data from the European Social Survey, which is based on a module carried out in one year only and does not cover all the member states gives rise to concerns about the reliability of the underlying data and the ensuing projections, especially in the case of small countries such as Cyprus.*

A: Obviously the scope and origin of data used for calculating OSPs affect their final form. The EPC try to use all available sources that are suitable, relevant and meet quite demanding conditions for including them into a common database. Beside US data (not only O*NET but also BLS) and ESS data we are using data from Germany, Italy and the Czech Republic. To obtain them is quite difficult and time-consuming (and sometimes you have to buy them), we have not succeeded in getting, for example, British Skill Survey data. I am afraid we have no better data sources available at this moment, and we would be very grateful for indicating us other possible sources.

We have to stress that a great advantage of US jobs skill requirements data is that they are updated regularly (O*NET annually, and BLS biannually). Moreover, the 5th round of the European Social Survey (ESS-5) in 2010-2011 has replicated the ESS-2 module (2004-2005) containing questions focused on education and work experience of respondents.

***Q**: In the Cedefop project, forecasts of employment by qualification level are provided. As already mentioned, there are strong reservations on the methodology of extrapolating past labour market data on the shares of employment by qualification level. The actual labour market data show the outcome of the interaction between the supply and demand of persons by qualification level. Therefore in the case of oversupply of persons with high qualifications they may, as a necessity, end up in occupations requiring medium or even low qualification levels. This is a phenomenon observed also in situations where countries have relatively large proportions of foreign workers, as these may accept working in lower level occupations despite their higher level qualifications in order to fulfil their basic needs. An extrapolation of such trends would result in forecasting need for persons with high qualifications to cover low level occupations.*

A: This question neatly re-formulates from a different angle of view the crucial problem of the distinction between qualification requirements of the job (which make the very contents of OSPs) and the qualification of job holders as indicated by formal education they have attained. The EPC share this view and separate both notions, working only with job characteristics as described by the seven dimensions of OSPs. The EPC don't make any forecasts themselves, but use forecasts of jobs defined by sector (38 industries) and

occupation (ISCO 2 digits) elaborated by the core project, and assign to forecasted jobs characteristics of their respective OSPs.

***Q**: Concerning required educational level and its link to the core projection – we have a demand side providing in principal the same information but very different numbers in the core project (e.g. CZ low educational level required based on OSP 1706 thousands. employed in 2000 and based on demand projection 315 thousands employed). How to deal with that in the interpretation?*

A: Again, the difference in numbers is explained by the distinction between job requirements as defined by OSPs and the actual qualification (education) of job holders. Both numbers relate to different notions: in the Czech Republic in 2000 there were 1706 thousand jobs where only a low level of education was required, however only 315 thousand of job holders had attained only the required low level of education, the rest was overqualified for the job. Such a big difference can be explained by the fact that the Czech Republic is one of few European countries with a very low proportion of adults who have not attained upper secondary education, and most of low skill jobs were held by people with a higher level of qualification (quite often with an upper secondary level vocational qualification).

***Q**: Required educational level – multiple sources have been used based on factor analysis (p. 17). Maybe the combination of these sources is not so good in this case. (Or more detailed results of the factor analysis will need to be published to fully understand the concept. Based on the documentation there was quite a big importance (weight) of CZ survey. But the Czech Republic has quite specific educational structure and it forms only a very little share of European total employment. Maybe simple selection of one source of data (probably ESS) will be a better solution here.*

In some countries the requirements can differ significantly from the EU average. It may be useful to measure these differences and if the differences are significant, than use for specific country its own results. Only in countries where the results are not available can then be used EU averages or results of country with similar economy and educational structure.

A: Because we have expanded the sources for constructing OSPs and their respective weights have changed, the weight of CZ surveys has been considerably reduced (see Chapter 1.3). The outcomes of factor analysis have tested and justified our approach but served only as a first clue for determining weights of various data sources.

The second part of the question proposes a theoretically sound approach but unfortunately impossible to be applied, as data sources required from individual countries are extremely insufficient. Moreover, with our experience of last several years we rather doubt that it is possible to use them consistently. The results differ considerably even within one country, depending on the design and methodology of data collection, the selection of respondents and on many other problems.

In the given context (the construction of OSPs for sector specific occupations) the ESS database can be used for identification of jobs only for the whole sample, not for individual countries, because their samples are too small.

However we are well aware of the need to construct country specific OSPs, because differences in perceiving qualification required between individual countries are quite marked. We have found how different they are not only by comparing the requirements in the

USA and in Europe, but also by comparing individual European countries. The EPC is preparing a new approach how to define country specific OSPs.

***Q**: The European Social Survey (ESS) is used for the provision of the first two characteristics of the occupational skills profiles, which are the level of education required and the field of education required. This analysis might have been useful provided the methodology of the ESS and the data collected were reliable. Unfortunately, the data required and finally used refers to only one particular module of the survey and does not cover all the member states. Furthermore, the extrapolation of the data into the future may provide unreliable forecasts as the requirements for levels and fields of education change over time. It must be noted that Cyprus was not included in the countries covered by the ESS module.*

***Q**: Regarding the methodology we have some doubts about the use of ESS and their representativeness. If we understand well, the ESS is used to construct the first two dimensions related to the level of education and training required and to the field of education and training required. The Spanish sample is enough big to gain representative results at this level of detail?*

A: We agree that the ESS in not representative enough for individual countries in the given context. We only use ESS-2 and ESS-5 data for the whole sample (see the previous answer as well).

***Q**: The outcome of the process is the provision of information for the five characteristics of knowledge, skills, competence, occupational interests and work values. As described in the paper, the main source of data is the occupational information network (O*NET) which is used by the US Department of Labor. There are strong reservations regarding the transposition of US data for estimating these five characteristics. The US perceptions about these characteristics may differ significantly from the EU perceptions, which in any case may vary between member states depending on the development stage of economic sectors and occupations and on other characteristics such as technological level, environmental issues, culture and tradition. This may be especially true in the case of small countries, such as Cyprus.*

A: Projects using the O*NET approach have been carried out in Italy and in the Czech Republic. Their results have been compared with those of the O*NET, and they seem to be similar enough. More details can be found in Chapter 1.4.

***Q**: The methodology for forecast is not described.*

A: The CEDEFOP employment forecast has been used for a number of jobs in the given sector (38 industries) and the given occupation (ISCO 2 digits).

***Q**: Fields of education: The strong concentration in Technical & engineering and Economics, etc makes one wish for more detail here. Is this available?*

A: Unfortunately not. We only have more detailed data for the field of education for some national sources (f.i. DE, CZ), but we do not think that their use for all European countries is appropriate.

***Q**: The level of skills and competencies etc. is published in %. What does hypothetical 100 % of a specific skill means?*

A: Please find Annex A.3 Level Scale Anchors for better understanding.

***Q**: How has self-employment been treated? Do all (or some of) the sources that have been used to establish the profiles cover self-employed?*

A: Self-employed people are covered by the ELFS database as well as by the BLS database. However the ECP does not use this characteristic.

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Annex

A.1 How Occupational Skills Profiles have been generated

As described in Chapter 2, Occupational Skills Profiles are structured into seven Dimensions. The first two Dimensions – grouped together as *Coordinating Characteristics* – relate to the level of education and training required (and hence to the complexity of the occupation), and to the field of education and training required. Three further Dimensions – together referred to as *Main Characteristics* – contain what is required to do the job in terms of theoretical and factual knowledge, cross-functional skills, and personal, social and methodological abilities. The last two Dimensions – under the heading of *Supplementary Characteristics* – add information relating to the profile and orientation of work, such as occupational interests (preferences for work environment) and work values (important to job satisfaction).

The data sources for the seven OSP Dimensions are described in detail in Chapters 1 and 2. The way how they have been used in order to generate them differs according to their origin – European or US – and to the Dimension in question. Generating Dimensions 3-7 is similar and as it is more complicated, it will be discussed first.

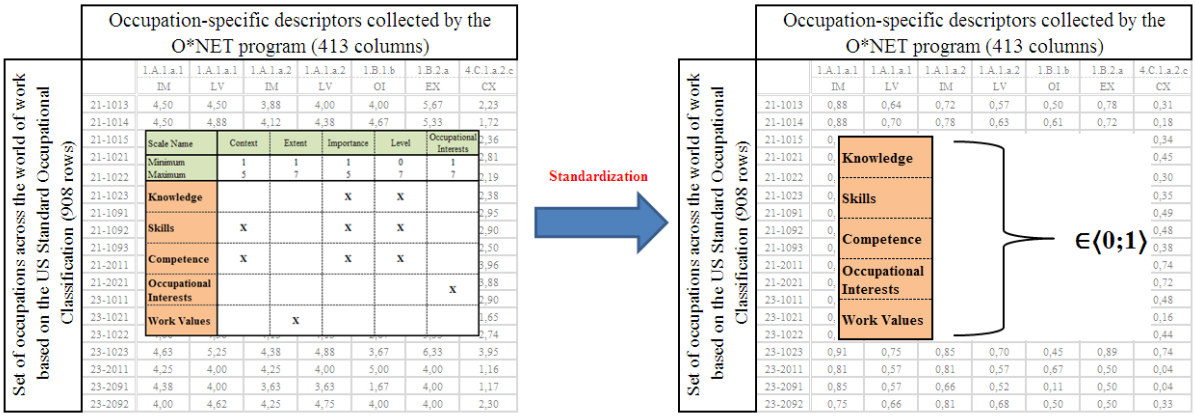
Computing dimensions 3 – 7

Step 1: <u>Standardise O*NET descriptors</u>

The matrix of O*NET descriptors is first converted (standardized) to the range 0 to 1.

<u>Input matrix</u>: The original O*NET database – US occupational groups (SOC) x Occupation-specific descriptors collected by the O*NET program (908 x 413 = 375 004 cells). These can take a variety of values depending on the particular descriptor chosen.

<u>Output matrix</u>: The standardized O*NET database – US occupational groups (SOC) x Standardized occupation-specific descriptors collected by the O*NET program (908 x 413 = 375 004 cells). Values of each descriptor are now standardised.



$$\forall_{i=1,\ldots,908;\ d=1,\ldots,413} \quad a_{id} = \frac{x_{id} - min_s}{max_s - min_s}$$, where

x_{id} … Elements of the input matrix
a_{id} … Elements of the output matrix

i … Occupational group
d … Occupation-specific descriptors collected by the O*NET program
s … Scale; s ∈{Context; Extent; Importance; Level; Occupational Interests}

Step 2: Transform <u>O*NET descriptors</u>

The matrix of standardized occupation-specific descriptors collected by the O*NET Program is transformed to the Occupational Skills Profile dimensions. The 413 O*NET descriptors are aggregated to 48 OSP "dimensions" (it is only 48 "dimensions", not 66 as set out above, because this part is only for dimension 3-7 and there is only 48 "dimensions". Other 18 "dimensions" covered to dimension 1 and 2). For detailed of assignation see Annex 2.

<u>Input matrix</u>: The standardized O*NET database – US occupational groups (SOC) x Standardized occupation-specific descriptors collected by the O*NET program (908 x 413 = 375 004 cells).

<u>Output matrix</u>: The matrix of OSP for US occupational groups (SOC) – US occupational groups (SOC) x OSP dimensions (908 x 48 = 43 584 cells).

Set of occupations across the world of work based on the US Standard Occupational Classification (908 rows)	Standardized occupation-specific descriptors collected by the O*NET program (413 columns)							
	1.A.1.a.1	1.A.1.a.1	1.A.1.a.2	1.A.1.a.2	1.B.1.b	1.B.2.a	4.C.1.a.2.e
	IM	LV	IM	LV	OI	EX	CX
21-1013	0,88	0,64	0,72	0,57	0,50	0,78	0,31
21-1014	0,88	0,70	0,78	0,63	0,61	0,72	0,18
21-1015	0,78	0,64	0,63	0,52	0,50	0,78	0,34
21-1021	0,88	0,63	0,81	0,59	0,39	0,83	0,45
21-1022	0,81	0,63	0,75	0,59	0,50	0,78	0,30
21-1023	0,81	0,64	0,72	0,64	0,61	0,83	0,35
21-1091	0,85	0,59	0,78	0,55	0,39	0,67	0,49
21-1092	0,85	0,57	0,63	0,52	0,22	0,50	0,48
21-1093	0,66	0,57	0,63	0,55	0,17	0,45	0,38
21-2011	0,81	0,64	0,85	0,63	0,17	0,95	0,74
21-2021	0,75	0,59	0,66	0,54	0,00	0,78	0,72
23-1011	0,85	0,71	0,85	0,68	0,61	0,83	0,48
23-1021	0,81	0,64	0,78	0,70	0,67	0,78	0,16
23-1022	0,75	0,64	0,78	0,59	0,28	0,72	0,44
23-1023	0,91	0,75	0,85	0,70	0,45	0,89	0,74
23-2011	0,81	0,57	0,81	0,57	0,67	0,50	0,04
23-2091	0,85	0,57	0,66	0,52	0,11	0,50	0,04
23-2092	0,75	0,66	0,81	0,68	0,50	0,50	0,33

Set of occupations across the world of work based on the US Standard Occupational Classification (908 rows)	Occupatinal Skills Profile dimensions 48 columns						
	Knowledge				Skills		Competence
	01 Education and Train		02 Arts and Humanities		01 Cognitive skills		01 Personal abilities
	IM	LV	IM	LV	IM	LV	IM
21-1013	0,68	0,69	0,41	0,40	0,73	0,61	0,84
21-1014	0,65	0,62	0,28	0,28	0,72	0,62	0,80
21-1015	0,73	0,65	0,25	0,24	0,51	0,44	0,72
21-1021	0,49	0,43	0,24	0,22	0,67	0,55	0,79
21-1022	0,59	0,62	0,34	0,32	0,66	0,57	0,80
21-1023	0,61	0,61	0,31	0,29	0,69	0,60	0,80
21-1091	0,82	0,86	0,34	0,32	0,68	0,54	0,82
21-1092	0,50	0,53	0,28	0,27	0,67	0,55	0,76
21-1093	0,55	0,51	0,28	0,27	0,60	0,51	0,74
21-2011	0,56	0,54	0,36	0,40	0,71	0,60	0,75
21-2021	0,77	0,77	0,37	0,37	0,59	0,50	0,79
23-1011	0,29	0,31	0,26	0,27	0,78	0,67	0,80
23-1021	0,33	0,33	0,24	0,22	0,75	0,66	0,72
23-1022	0,60	0,66	0,35	0,35	0,68	0,56	0,82
23-1023	0,65	0,63	0,38	0,41	0,78	0,69	0,82
23-2011	0,34	0,38	0,23	0,20	0,62	0,52	0,71
23-2091	0,24	0,21	0,23	0,22	0,42	0,36	0,67

$$\forall_{i=1,\dots,908;d=1,\dots,48} \quad a_{id} = \frac{\sum_{j=1}^{N_d} x_{ij}}{N_d}$$, where

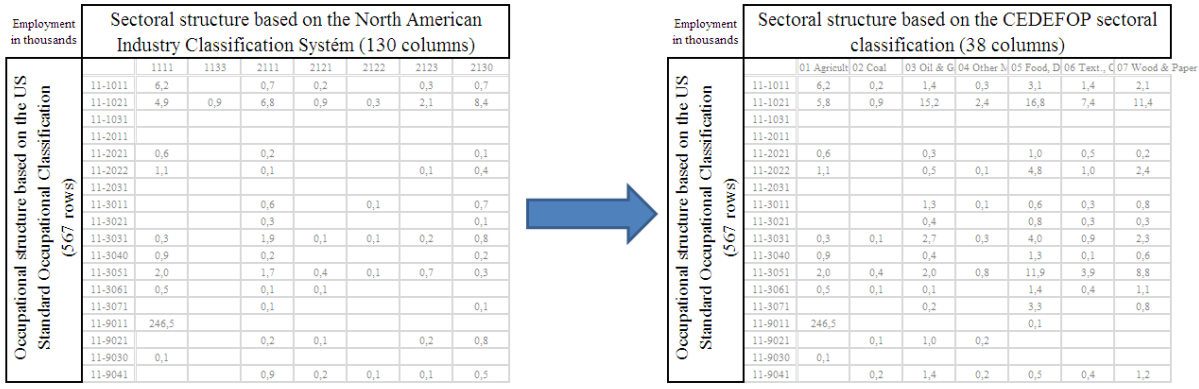
x_{ij} … Elements of input matrix
a_{id} … Elements of output matrix
i … Occupational group
d … OSP dimension
N_d … Number of Occupation-specific descriptors collected by the O*NET program covered by the OSP dimension *d*

Step 3: <u>Generating a Mapping from US NAICS to NACE categories</u>

The industry categories used in the latest US National Employment Matrix (for last version it is Matrix with 2008 data) are converted to the NACE classification used in the main CEDEFOP projections.

<u>Input matrix</u>: The latest US National Employment Matrix, industry employment by occupation – US occupation groups (SOC) x US industrial groups (NAICS) (567 x 130 = 73 710 cells).

<u>Output matrix</u>: The modified US National Employment Matrix (it is employment in the USA in combination of US SOC and European NACE categories); industry employment by occupation – US occupation groups (SOC) x CEDEFOP sectoral groups[2] (567 x 38 = 21 546 cells).



Employment in thousands	Sectoral structure based on the North American Industry Classification Systém (130 columns)						
Occupational structure based on the US Standard Occupational Classification (567 rows)	1111	1133	2111	2121	2122	2123	2130
11-1011	6,2		0,7	0,2		0,3	0,7
11-1021	4,9	0,9	6,8	0,9	0,3	2,1	8,4
11-1031							
11-2011							
11-2021	0,6		0,2				0,1
11-2022	1,1		0,1			0,1	0,4
11-2031							
11-3011			0,6		0,1		0,7
11-3021			0,3				0,1
11-3031	0,3		1,9	0,1	0,1	0,2	0,8
11-3040	0,9		0,2				0,2
11-3051	2,0		1,7	0,4	0,1	0,7	0,3
11-3061	0,5		0,1	0,1			
11-3071			0,1				0,1
11-9011	246,5						
11-9021			0,2	0,1		0,2	0,8
11-9030	0,1						
11-9041			0,9	0,2	0,1	0,1	0,5

Employment in thousands	Sectoral structure based on the CEDEFOP sectoral classification (38 columns)						
Occupational structure based on the US Standard Occupational Classification (567 rows)	01 Agricult	02 Coal	03 Oil & G	04 Other M	05 Food, D	06 Text., C	07 Wood & Paper
11-1011	6,2	0,2	1,4	0,3	3,1	1,4	2,1
11-1021	5,8	0,9	15,2	2,4	16,8	7,4	11,4
11-1031							
11-2011							
11-2021	0,6		0,3		1,0	0,5	0,2
11-2022	1,1		0,5	0,1	4,8	1,0	2,4
11-2031							
11-3011			1,3	0,1	0,6	0,3	0,8
11-3021			0,4		0,8	0,3	0,3
11-3031	0,3	0,1	2,7	0,3	4,0	0,9	2,3
11-3040	0,9		0,4		1,3	0,1	0,6
11-3051	2,0	0,4	2,0	0,8	11,9	3,9	8,8
11-3061	0,5	0,1	0,1		1,4	0,4	1,1
11-3071			0,2		3,3		0,8
11-9011	246,5				0,1		
11-9021		0,1	1,0	0,2			
11-9030	0,1						
11-9041		0,2	1,4	0,2	0,5	0,4	1,2

$$\forall_{i=1,\ldots,567;\ d=1,\ldots,38} \quad a_{id} = \sum_{j=1}^{N_d} x_{ij}$$, where

x_{ij} … Number employed in occupation *i* in the sectoral group *j* (elements of the input matrix)
a_{id} … Number employed in occupation *i* in the sectoral group *d* (elements of the output matrix)
i … Occupational group (SOC classification)
j … Sectoral group (NAICS classification)
d … Sectoral group (CEDEFOP classification)
N_d … Number of sectoral groups defined by the NAICS covered by the CEDEFOP sectoral group *d*

[2] In the main CEDEFOP project Cambridge Econometrics use the E3ME model, in which the structure of sectors is based on the NACE Rev.1.1 classification. The number of sectors has been reduced in E3ME by aggregation to 41. EPC use basically the same classification here. However the number of sectors has been further reduced to just 38, as three pairs of sectors had to be combined due to data limitations. The first combined sector unites Pharmaceuticals (10) and Chemicals (11), the second one Electricity (22) and Gas Supply (23), and the third one Professional Services (36) and Other Business Services (37).

Step 4: <u>Development of sector-specific weights</u>

In this step sector specific weights are developed (for the aggregated CEDEFOP 38 sectors, Ind 38) for computing OSPs for occupational groups based on ISCO 3 digit categories (ISCO 3D).

<u>Input matrix</u>: The modified Employment Matrix from Step 3, which is industry employment by occupation – US occupational groups (SOC) and ISCO 3D groups (103) x CEDEFOP sectoral groups (567 x 38 = 21 546 cells).

<u>Output matrix</u>: The matrix of weights for the occupational group *i* (SOC classification) in the occupational group *j* (ISCO 3D classification) in the sectoral group *d* (CEDEFOP sectoral classification).

Employment in thousands

Sectoral structure based on the CEDEFOP sectoral classification (38 columns)

Occupational structure based on the ISCO 3D and US Standard Occupational Classification (567 rows)

ISCO 3D	SOC code	01 Agricult	02 Coal (10	03 Oil & G	04 Other M	05 Food, D	06 Text., Cloth, & Leath (17-19)
121	11-1011	6,2	0,2	1,4	0,3	3,1	1,4
122	11-3051	2,0	0,4	2,0	0,8	11,9	3,9
	11-9131						
	11-9199	1,2	0,1	1,1	0,3	1,9	0,1
123	11-2011						
	11-2020	1,7	0,1	0,8	0,2	4,5	1,5
	11-2031						
	11-3021			0,4		0,8	0,3
	11-3031	0,3	0,1	2,7	0,3	4,0	0,9
	11-3040	0,9		0,4		1,3	0,1
	11-3061	0,5	0,1	0,1		1,4	0,4
	11-9041		0,2	1,4	0,2	0,5	0,4
	11-9111						
	11-9121			0,2		0,3	
131	11-1021	5,8	0,9	15,2	2,4	16,8	7,4
	11-3011			1,3	0,1	0,6	0,3
	11-3071			0,2		3,3	
	11-9011	246,5				0,1	

Share of US SOC groups in ISCO3D group in given sector

Sectoral structure based on the CEDEFOP sectoral classification (38 columns)

Occupational structure based on the ISCO 3D and US Standard Occupational Classification (567 rows)

ISCO 3D	SOC code	01 Agricult	02 Coal (10	03 Oil & G	04 Other M	05 Food, D	06 Text., Cloth,
121	11-1011	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%
122	11-3051	62,5%	80,0%	64,5%	72,7%	86,2%	97,5%
	11-9131	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%
	11-9199	37,5%	20,0%	35,5%	27,3%	13,8%	2,5%
123	11-2011	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%
	11-2020	50,0%	20,0%	13,3%	28,6%	35,2%	41,7%
	11-2031	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%
	11-3021	0,0%	0,0%	6,7%	0,0%	6,3%	8,3%
	11-3031	8,8%	20,0%	45,0%	42,9%	31,3%	25,0%
	11-3040	26,5%	0,0%	6,7%	0,0%	10,2%	2,8%
	11-3061	14,7%	20,0%	1,7%	0,0%	10,9%	11,1%
	11-9041	0,0%	40,0%	23,3%	28,6%	3,9%	11,1%
	11-9111	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%
	11-9121	0,0%	0,0%	3,3%	0,0%	2,3%	0,0%
131	11-1021	2,0%	11,4%	30,3%	18,2%	14,9%	21,0%
	11-3011	0,0%	0,0%	2,6%	0,8%	0,5%	0,8%
	11-3071	0,0%	0,0%	0,4%	0,0%	2,9%	0,0%
	11-9011	86,1%	0,0%	0,0%	0,0%	0,1%	0,0%

$$\forall_{j=1,\dots,103;\ d=1,\dots,38}\quad w_{ijd} = \frac{a_{id}}{\sum_{i=1}^{567} k_{ij}.a_{id}}$$, where

w_{ijd} …Weight (or share) of the occupational group *i* in occupational group *j* in sectoral group *d* (elements of the output matrix)

a_{id} …Number employed in the US SOC occupational group *i* in sectoral group *d* (elements of the input matrix)

i … Occupational group (SOC classification)

j … Occupational group (ISCO 3D classification)

d … Sectoral group (CEDEFOP classification)

$$k_{ij} = \begin{cases} 0 \dots \text{occupation group } i \text{ (SOC classification) is not a part of occupational group } j \text{ (ISCO 3D classification)} \\ 1 \dots \text{occupation group } i \text{ (SOC classification) is a part of occupational group } j \text{ (ISCO 3D classification)} \end{cases}$$

Mapping the US SOC occupational group to ISCO 3D groups is based on correspondence table created by EPC.

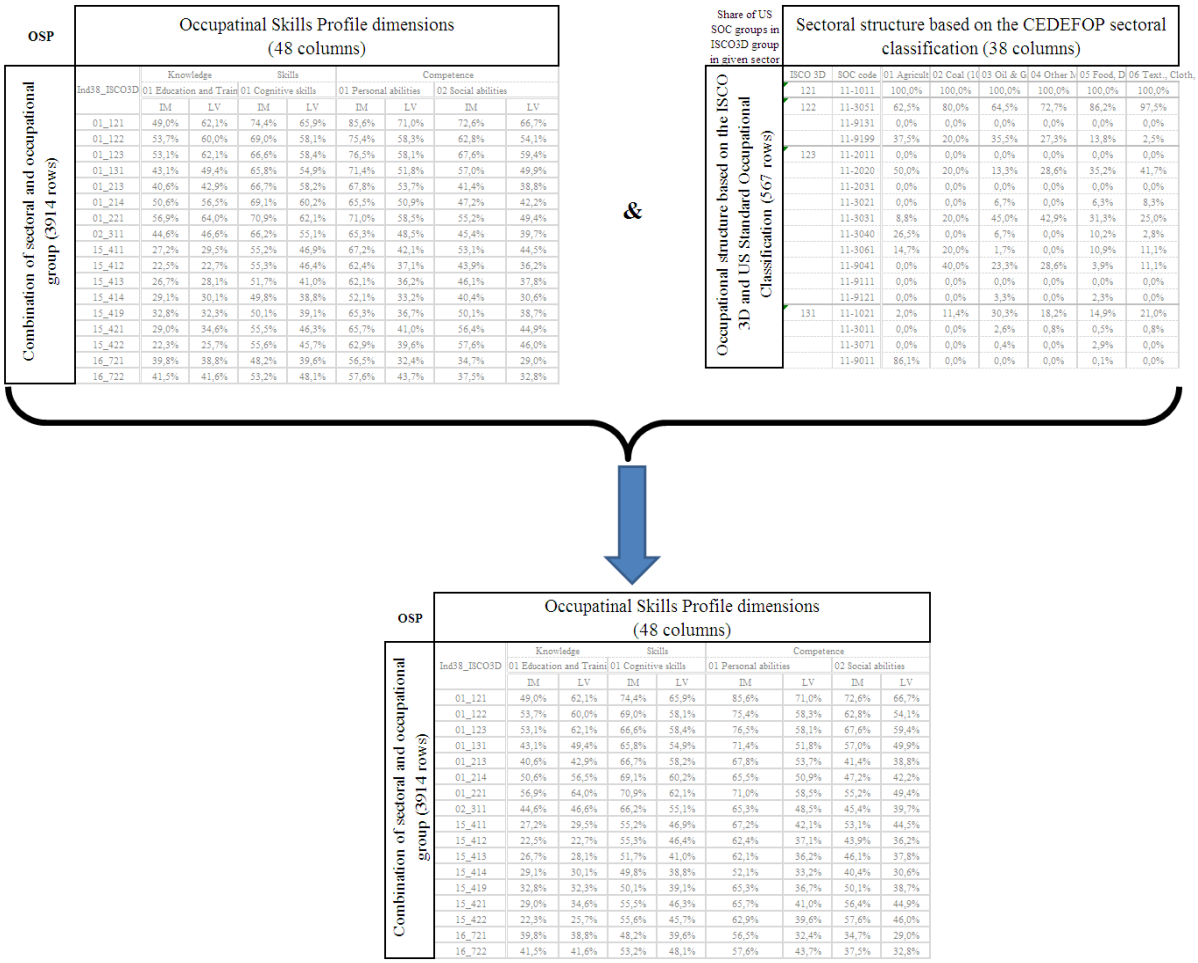
Step 5: <u>Development of sector-specific OSPs</u>

In this Step sector specific Occupational Skills Profiles are computed. They are computed for each combination of occupations (ISCO 3D) and sectors (38 sectoral groups).

<u>Input matrixes</u>:

- The matrix of OSP for US occupational groups (SOC) – US occupational groups (SOC) x OSP dimensions (908 x 48 = 43 584 cells), from Step 2, and
- The matrix of weights for the occupational group *i* (SOC classification) in the occupational group *j* (ISCO 3D classification) in the sectoral group *d* (CEDEFOP sectoral classification) (567 x 38 = 21 546 cells), from Step 4.

<u>Output matrix</u>: The matrix of OSP for each combination Occupation (ISCO 3D or ISCO 2D) x Sector (Ind 38)

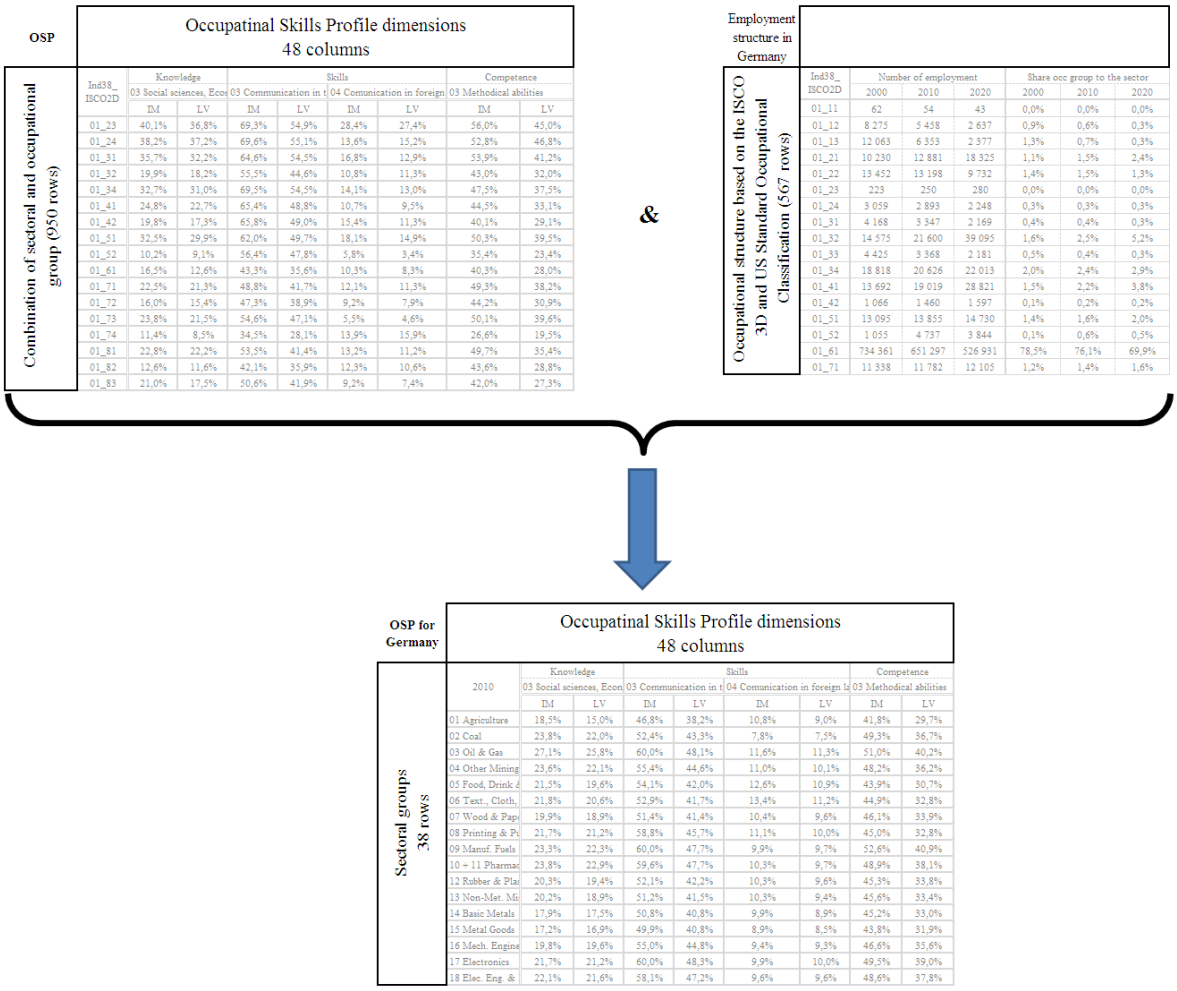


As in the Core project the ISCO 2D classification is used, the OSP matrix computed in this step (ISCO 3D x Ind 38) is transformed to the matrix ISCO2D x Ind 38. As a weight, the employment structure of the EU19[3] is used.

[3] The EU19 covers EU15 countries + Czech Republic + Hungary + Poland +Slovakia; Only EU19 is used because authors have no data for ISCO 3D for all European countries.

Step 6: Generate OSPs for all industries

In the last step OSPs are computed for each country. They are based on its particular employment structure (occupation x sectors).



Computing Dimensions 1 and 2

The approach is not so complicated here. European sources (such as ESS or BIBB) use the ISCO x NACE classifications. It is straightforward to find the value of Dimension 1 and 2 in OSPs for each necessary combination of the ISCO 2 digit (ISCO 2D) and NACE industry category (in particular the 38 categories used here (Ind 38).

For the US data the procedure required is the same as described in Steps 4 to 6 in the previous section.

A.2 Assigning variables from O*NET

Dimension III – Knowledge

Main dimension	Detail dimension	O*NET code	O*NET name
Knowledge	01 Education and Training	2.C.6	Education and Training
	02 Arts and Humanities	2.C.3.c	Design
		2.C.7.a	Mother Language
		2.C.7.c	Fine Arts
		2.C.7.d	History and Archeology
		2.C.7.e	Philosophy and Theology
		2.C.9.b	Communications and Media
	03 Social sciences, Economy and Law	2.C.1.c	Economics and Accounting
		2.C.4.e	Psychology
		2.C.4.f	Sociology and Anthropology
		2.C.8.b	Law and Government
	04 Sciences, Mathematics and Computers	2.C.4.a	Mathematics
		2.C.4.b	Physics
		2.C.4.c	Chemistry
		2.C.4.d	Biology
		2.C.4.g	Geography
	05 Engineering, Technology, Production and Processing	2.C.2.a	Production and Processing
		2.C.2.b	Food Production
		2.C.3.a	Computers and Electronics
		2.C.3.b	Engineering and Technology
		2.C.3.d	Building and Construction
		2.C.3.e	Mechanical
	06 Helath services	2.C.5.a	Medicine and Dentistry
		2.C.5.b	Therapy and Counseling
	07 Services	2.C.1.e	Customer and Personal Service
		2.C.10	Transportation
		2.C.8.a	Public Safety and Security
		2.C.9.a	Telecommunications
	08 Bussiness and Management	2.C.1.a	Administration and Management
		2.C.1.b	Clerical
		2.C.1.d	Sales and Marketing
		2.C.1.f	Personnel and Human Resources

Dimension IV – Skills

Main dimension	Detail dimension	O*NET code	O*NET name
Skills	01 Cognitive skills	1.A.1.b.4	Deductive Reasoning
		1.A.1.b.5	Inductive Reasoning
		1.A.1.b.6	Information Ordering
		1.A.1.b.7	Category Flexibility
		1.C.7.b	Analytical Thinking
		2.A.2.a	Critical Thinking
		2.A.2.b	Active Learning
		2.B.2.i	Complex Problem Solving
		4.A.2.a.1	Judging the Qualities of Things, Services, or People
		4.A.2.a.2	Processing Information
		4.A.2.a.3	Evaluating Information to Determine Compliance with Standards
		4.A.2.a.4	Analyzing Data or Information
		4.A.2.b.1	Making Decisions and Solving Problems
		4.A.2.b.3	Updating and Using Relevant Knowledge
	02 Practical skills	2.B.3.a	Operations Analysis
		2.B.3.b	Technology Design
		2.B.3.c	Equipment Selection
		2.B.3.d	Installation
		2.B.3.g	Operation Monitoring
		2.B.3.h	Operation and Control
		2.B.3.j	Equipment Maintenance
		2.B.3.k	Troubleshooting
		2.B.3.l	Repairing
		2.B.3.m	Quality Control Analysis
		4.A.1.a.1	Getting Information
		4.A.1.a.2	Monitor Processes, Materials, or Surroundings
		4.A.1.b.1	Identifying Objects, Actions, and Events
		4.A.1.b.2	Inspecting Equipment, Structures, or Material
		4.A.1.b.3	Estimating the Quantifiable Characteristics of Products, Events, or Information
		4.A.3.b.1	Interacting With Computers
		4.A.3.b.2	Drafting, Laying Out, and Specifying Technical Devices, Parts, and Equipment
		4.A.3.b.4	Repairing and Maintaining Mechanical Equipment
		4.A.3.b.5	Repairing and Maintaining Electronic Equipment
		4.A.3.b.6	Documenting/Recording Information
	03 Communication in the mother language	1.A.1.a.1	Oral Comprehension
		1.A.1.a.2	Written Comprehension
		1.A.1.a.3	Oral Expression
		1.A.1.a.4	Written Expression
		2.A.1.a	Reading Comprehension
		2.A.1.b	Active Listening
		2.A.1.c	Writing
		2.A.1.d	Speaking
		4.A.4.a.1	Interpreting the Meaning of Information for Others
		4.A.4.a.2	Communicating with Supervisors, Peers, or Subordinates
		4.A.4.a.3	Communicating with Persons Outside Organization
		4.A.4.a.8	Performing for or Working Directly with the Public
		4.C.1.a.2.c	Public Speaking
		4.C.1.a.2.f	Telephone
		4.C.1.a.2.h	Electronic Mail
		4.C.1.a.2.j	Letters and Memos
		4.C.1.a.2.l	Face-to-Face Discussions
		4.C.1.a.4	Contact With Others
	04 Comunication in foreign languages	2.C.7.b	Foreign Language
	05 Numeracy + basic SMT concepts	1.A.1.c.1	Mathematical Reasoning
		1.A.1.c.2	Number Facility
		2.A.1.e	Mathematics
		2.A.1.f	Science
	06 ICT/digital	2.B.3.e	Programming
	07 Learning to learn	2.A.2.c	Learning Strategies

Dimension V – Competence

Main dimension	Detail dimension	O*NET code	O*NET name
Competence	01 Personal abilities	1.A.1.b.1	Fluency of Ideas
		1.A.1.b.2	Originality
		1.A.1.b.3	Problem Sensitivity
		1.C.1.a	Achievement/Effort
		1.C.1.b	Persistence
		1.C.1.c	Initiative
		1.C.2.b	Leadership
		1.C.3.a	Cooperation
		1.C.3.b	Concern for Others
		1.C.4.a	Self Control
		1.C.4.b	Stress Tolerance
		1.C.4.c	Adaptability/Flexibility
		1.C.5.a	Dependability
		1.C.5.c	Integrity
		1.C.6	Independence
		1.C.7.a	Innovation
		2.A.2.d	Monitoring
		4.A.2.b.2	Thinking Creatively
	02 Social abilities	2.B.1.a	Social Perceptiveness
		2.B.1.b	Coordination
		2.B.1.c	Persuasion
		2.B.1.d	Negotiation
		2.B.1.e	Instructing
		2.B.1.f	Service Orientation
		4.A.4.a.4	Establishing and Maintaining Interpersonal Relationships
		4.A.4.a.5	Assisting and Caring for Others
		4.A.4.a.6	Selling or Influencing Others
		4.A.4.a.7	Resolving Conflicts and Negotiating with Others
		4.C.1.b.1.e	Work With Work Group or Team
	03 Methodical abilities	2.B.4.e	Judgment and Decision Making
		2.B.4.g	Systems Analysis
		2.B.4.h	Systems Evaluation
		2.B.5.a	Time Management
		2.B.5.b	Management of Financial Resources
		2.B.5.c	Management of Material Resources
		2.B.5.d	Management of Personnel Resources
		4.A.2.b.4	Developing Objectives and Strategies
		4.A.2.b.5	Scheduling Work and Activities
		4.A.2.b.6	Organizing, Planning, and Prioritizing Work
		4.A.4.b.1	Coordinating the Work and Activities of Others
		4.A.4.b.2	Developing and Building Teams
		4.A.4.b.3	Training and Teaching Others
		4.A.4.b.4	Guiding, Directing, and Motivating Subordinates
		4.A.4.b.5	Coaching and Developing Others
		4.A.4.b.6	Provide Consultation and Advice to Others
		4.A.4.c.2	Staffing Organizational Units
		4.A.4.c.3	Monitoring and Controlling Resources
		4.C.1.b.1.g	Coordinate or Lead Others
		4.C.1.c.2	Responsibility for Outcomes and Results
		4.C.3.a.1	Consequence of Error
		4.C.3.a.2.a	Impact of Decisions on Co-workers or Company Results
		4.C.3.a.2.b	Frequency of Decision Making
		4.C.3.a.4	Freedom to Make Decisions
		4.C.3.b.8	Structured versus Unstructured Work
		4.C.3.d.1	Time Pressure

Dimension VI – Occupational Interests

Main dimension	Detail dimension	O*NET code	O*NET name
Occupational Interests	Artistic	1.B.1.c	Artistic
	Conventional	1.B.1.f	Conventional
	Enterprising	1.B.1.e	Enterprising
	Investigative	1.B.1.b	Investigative
	Realistic	1.B.1.a	Realistic
	Social	1.B.1.d	Social

Dimension VII – Work Values

Main dimension	Detail dimension	O*NET code	O*NET name
Work Values	Achievement	1.B.2.a	Achievement
	Independence	1.B.2.f	Independence
	Recognition	1.B.2.c	Recognition
	Relationships	1.B.2.d	Relationships
	Support	1.B.2.e	Support
	Working Conditions	1.B.2.b	Working Conditions

A.3 Level Scale Anchors

Element ID	Element Name	OSP group / OSP subgroup	Anchor %	Anchor Description
1.A.1.a.1	Oral Comprehension	Skills	29%	Understand a television commercial
		03 Communication in the mother language	57%	Understand a coach's oral instructions for a sport
			86%	Understand a lecture on advanced physics
1.A.1.a.2	Written Comprehension	Skills	29%	Understand signs on the highway
		03 Communication in the mother language	57%	Understand an apartment lease
			86%	Understand an instruction book on repairing missile guidance systems
1.A.1.a.3	Oral Expression	Skills	29%	Cancel newspaper delivery by phone
		03 Communication in the mother language	57%	Give instructions to a lost motorist
			86%	Explain advanced principles of genetics to college freshmen
1.A.1.a.4	Written Expression	Skills	14%	Write a note to remind someone to take food out of the freezer
		03 Communication in the mother language	57%	Write a job recommendation for a subordinate
			86%	Write an advanced economics textbook
1.A.1.b.1	Fluency of Ideas	Competence	29%	Name four different uses for a screwdriver
		01 Personal abilities	57%	Think of as many ideas as possible for the name of a new company
			86%	Name all the possible strategies for a military battle
1.A.1.b.2	Originality	Competence	29%	Use a credit card to open a locked door
		01 Personal abilities	57%	Redesign job tasks to be interesting for employees
			86%	Invent a new type of man-made fiber
1.A.1.b.3	Problem Sensitivity	Competence	29%	Recognize that an unplugged lamp won't work
		01 Personal abilities	57%	Recognize from the mood of prisoners that a prison riot is likely to occur
			86%	Recognize an illness at an early stage of a disease when there are only a few symptoms
1.A.1.b.4	Deductive Reasoning	Skills	29%	Know that a stalled car can coast downhill
		01 Cognitive skills	71%	Decide what factors to consider in selecting stocks
			86%	Design an aircraft wing using principles of aerodynamics
1.A.1.b.5	Inductive Reasoning	Skills	29%	Decide what to wear based on the weather report
		01 Cognitive skills	57%	Determine the prime suspect based on crime scene evidence
			86%	Diagnose a disease using results of many different lab tests
1.A.1.b.6	Information Ordering	Skills	14%	Put things in numerical order
		01 Cognitive skills	29%	Follow the correct steps to make change
			86%	Assemble a nuclear warhead
1.A.1.b.7	Category Flexibility	Skills	29%	Sort nails in a toolbox on the basis of length
		01 Cognitive skills	43%	Classify flowers according to size, color, and smell
			86%	Classify man-made fibers in terms of their strength, cost, flexibility, melting points, etc.
1.A.1.c.1	Mathematical Reasoning	Skills	14%	Determine how much 10 oranges will cost when they are priced at 2 for 20 cents
		05 Numeracy + basic SMT concepts	57%	Decide how to calculate profits to determine the amounts of yearly bonuses
			86%	Determine the mathematics required to simulate a space craft landing on the moon
1.A.1.c.2	Number Facility	Skills	14%	Add 2 and 7
		05 Numeracy + basic SMT concepts	43%	Balance a checkbook
			71%	Compute the interest payment that should be generated from an investment
2.A.1.a	Reading Comprehension	Skills	29%	Read step-by-step instructions for completing a form
		03 Communication in the mother language	57%	Read a memo from management describing new personnel policies
			86%	Read a scientific journal article describing surgical procedures
2.A.1.b	Active Listening	Skills	29%	Take a customer's order
		03 Communication in the mother language	57%	Answer inquiries regarding credit references
			86%	Preside as judge in a complex legal disagreement
2.A.1.c	Writing	Skills	29%	Take a telephone message
		03 Communication in the mother language	57%	Write a memo to staff outlining new directives
			86%	Write a novel for publication
2.A.1.d	Speaking	Skills	29%	Greet tourists and explain tourist attractions
		03 Communication in the mother language	57%	Interview applicants to obtain personal and work history
			86%	Argue a legal case before the Supreme Court
2.A.1.e	Mathematics	Skills	29%	Count the amount of change to be given to a customer
		05 Numeracy + basic SMT concepts	57%	Calculate the square footage of a new home under construction
			86%	Develop a mathematical model to simulate and resolve an engineering problem
2.A.1.f	Science	Skills	29%	Conduct standard tests to determine soil quality
		05 Numeracy + basic SMT concepts	57%	Conduct product tests to ensure safety standards are met, following written instructions
			86%	Conduct analyses of aerodynamic systems to determine the practicality of an aircraft design

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2.A.2.a	Critical Thinking	Skills	29%	Determine whether a subordinate has a good excuse for being late
		01 Cognitive skills	57%	Evaluate customer complaints and determine appropriate responses
			86%	Write legal brief challenging a federal law
2.A.2.b	Active Learning	Skills	29%	Think about the implications of a newspaper article for job opportunities
		01 Cognitive skills	57%	Determine the impact of new menu changes on a restaurant's purchasing requirements
			86%	Identify the implications of a new scientific theory for product design
2.A.2.c	Learning Strategies	Skills	29%	Learn a different method of completing a task from a coworker
		07 Learning to learn	57%	Identify an alternative approach that might help trainees who are having difficulties
			86%	Apply principles of educational psychology to develop new teaching methods
2.A.2.d	Monitoring	Competence	29%	Proofread and correct a letter
		01 Personal abilities	57%	Monitor a meeting's progress and revise the agenda to ensure that important topics are discussed
			86%	Review corporate productivity and develop a plan to increase productivity
2.B.1.a	Social Perceptiveness	Competence	29%	Notice that customers are angry because they have been waiting too long
		02 Social abilities	57%	Be aware of how a coworker's promotion will affect a work group
			86%	Counsel depressive patients during a crisis period
2.B.1.b	Coordination	Competence	29%	Schedule appointments for a medical clinic
		02 Social abilities	57%	Work with others to put a new roof on a house
			86%	Work as director of a consulting project calling for interaction with multiple subcontractors
2.B.1.c	Persuasion	Competence	29%	Solicit donations for a charity
		02 Social abilities	57%	Convince a supervisor to purchase a new copy machine
			86%	Change the opinion of the jury in a complex legal case
2.B.1.d	Negotiation	Competence	29%	Present justification to a manager for altering work schedule
		02 Social abilities	57%	Contract with a wholesaler to sell items at a given cost
			86%	Work as an ambassador in negotiating a new treaty
2.B.1.e	Instructing	Competence	29%	Instruct a new employee in the use of a time clock
		02 Social abilities	57%	Instruct a coworker in how to operate a software program
			86%	Demonstrate surgical procedure to interns in a teaching hospital
2.B.1.f	Service Orientation	Competence	29%	Ask customers if they would like cups of coffee
		02 Social abilities	57%	Make flight reservations for customers, using airline reservation system
			86%	Direct relief agency operations in a disaster area
2.B.2.i	Complex Problem Solving	Skills	29%	Lay out tools to complete a job
		01 Cognitive skills	57%	Redesign a floor layout to take advantage of new manufacturing techniques
			86%	Develop and implement a plan to provide emergency relief for a major metropolitan area
2.B.3.a	Operations Analysis	Skills	29%	Select a photocopy machine for an office
		02 Practical skills	57%	Suggest changes in software to make a system more user friendly
			86%	Identify the control system needed for a new process production plant
2.B.3.b	Technology Design	Skills	29%	Adjust exercise equipment for use by a customer
		02 Practical skills	57%	Redesign the handle on a hand tool for easier gripping
			86%	Create new technology for producing industrial diamonds
2.B.3.c	Equipment Selection	Skills	29%	Select a screwdriver to use in adjusting a vehicle's carburetor
		02 Practical skills	57%	Choose a software application to use to complete a work assignment
			86%	Identify the equipment needed to produce a new product line
2.B.3.d	Installation	Skills	29%	Install a new air filter in an air conditioner
		02 Practical skills	57%	Install new switches for a telephone exchange
			86%	Install a "one of a kind" process production molding machine
2.B.3.e	Programming	Skills	29%	Write a program in BASIC to sort objects in a database
		06 ICT/digital	57%	Write a statistical analysis program to analyze demographic data
			86%	Write expert system programs to analyze ground radar geological data for probable existence of mineral deposits
2.B.3.g	Operation Monitoring	Skills	29%	Monitor completion times while running a computer program
		02 Practical skills	57%	Monitor machine functions on an automated production line
			86%	Monitor and integrate control feedback in a petrochemical processing facility to maintain production flow
2.B.3.h	Operation and Control	Skills	29%	Adjust the settings on a copy machine to make reduced size photocopies
		02 Practical skills	57%	Adjust the speed of assembly line equipment based on the type of product being assembled
			86%	Control aircraft approach and landing at a large airport during a busy period
2.B.3.j	Equipment Maintenance	Skills	29%	Add oil to an engine as indicated by a gauge or warning light
		02 Practical skills	57%	Clean moving parts in production machinery
			86%	Conduct maintenance checks on an experimental aircraft
2.B.3.k	Troubleshooting	Skills	29%	Identify the source of a leak by looking under a machine
		02 Practical skills	57%	Identify the circuit causing an electrical system to fail
			86%	Direct the debugging of control code for a new operating system
2.B.3.l	Repairing	Skills	29%	Tighten a screw to get a door to close properly
		02 Practical skills	57%	Replace a faulty hydraulic valve
			86%	Repair structural damage after an earthquake
2.B.3.m	Quality Control Analysis	Skills	29%	Inspect a draft memorandum for clerical errors
		02 Practical skills	57%	Measure new part requisitions for tolerance to specifications
			86%	Develop procedures to test a prototype of a new computer system

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2.B.4.e	Judgment and Decision Making	Competence	29%	Decide how scheduling a break will affect work flow
		03 Methodical abilities	57%	Evaluate a loan application for degree of risk
			86%	Decide whether a manufacturing company should invest in new robotics technology
2.B.4.g	Systems Analysis	Competence	29%	Determine how loss of a team member will affect the completion of a job
		03 Methodical abilities	57%	Determine how the introduction of a new piece of equipment will affect production rates
			86%	Identify how changes in tax laws are likely to affect preferred sites for manufacturing operations in different industries
2.B.4.h	Systems Evaluation	Competence	29%	Determine why a co-worker has been overly optimistic about how long it would take to complete a task
		03 Methodical abilities	57%	Identify the major reasons why a client might be unhappy with a product
			86%	Evaluate the long-term performance problem of a new computer system
2.B.5.a	Time Management	Competence	29%	Keep a monthly calendar of appointments
		03 Methodical abilities	57%	Allocate the time of subordinates to projects for the coming week
			86%	Allocate the time of scientists to multiple research projects
2.B.5.b	Management of Financial Resources	Competence	29%	Take money from petty cash to buy office supplies and record the amount of the expenditure
		03 Methodical abilities	57%	Prepare and manage a budget for a short-term project
			86%	Develop and approve yearly budgets for a large corporation and obtain financing as necessary
2.B.5.c	Management of Material Resources	Competence	29%	Rent a meeting room for a management meeting
		03 Methodical abilities	57%	Evaluate an annual uniform service contract for delivery drivers
			86%	Determine the computer system needs of a large corporation and monitor use of the equipment
2.B.5.d	Management of Personnel Resources	Competence	29%	Encourage a coworker who is having difficulty finishing a piece of work
		03 Methodical abilities	57%	Direct the activities of a road repair crew with minimal disruption of traffic flow
			86%	Plan, implement, and manage recruitment, training, and incentive programs for a high performance company
2.C.1.a	Administration and Management	Knowledge	29%	Sign a pay voucher
		08 Bussiness and Management	57%	Monitor progress of a project to ensure timely completion
			86%	Manage a $10 million company
2.C.1.b	Clerical	Knowledge	29%	File letters alphabetically
		08 Bussiness and Management	43%	Type 30 words per minute
			71%	Organize a storage system for company forms
2.C.1.c	Economics and Accounting	Knowledge	29%	Answer billing questions from credit card customers
		03 Social sciences, Economy and Law	57%	Develop financial investment programs for individual clients
			86%	Keep a major corporation's financial records
2.C.1.d	Sales and Marketing	Knowledge	29%	Sell cakes at a bake sale
		08 Bussiness and Management	57%	Call a list of clients to introduce them to a new product line
			86%	Develop a marketing plan for a nationwide telephone system
2.C.1.e	Customer and Personal Service	Knowledge	29%	Process customer dry-cleaning drop off
		07 Services	57%	Work as a day care aide supervising 10 children
			86%	Respond to a citizen's request for assistance after a major disaster
2.C.1.f	Personnel and Human Resources	Knowledge	29%	Fill out a medical claim form
		08 Bussiness and Management	43%	Interview applicants for a secretarial position
			86%	Design a new personnel selection and promotion system for the Army
2.C.10	Transportation	Knowledge	29%	Ride a train to work
		07 Services	71%	Steer a large freighter through a busy harbor
			86%	Control air traffic at a busy airport
2.C.2.a	Production and Processing	Knowledge	29%	Put a computer back into its packing materials
		05 Engineering, Technology, Production and Processing	57%	Supervise an appliance assembly line
			86%	Manage an international shipping company distribution center
2.C.2.b	Food Production	Knowledge	29%	Keep an herb box in the kitchen
		05 Engineering, Technology, Production and Processing	71%	Operate a commercial fishing boat
			86%	Run a 100,000-acre farm
2.C.3.a	Computers and Electronics	Knowledge	14%	Operate a VCR to watch a pre-recorded training tape
		05 Engineering, Technology, Production and Processing	43%	Use a word processor
			86%	Create a program to scan computer disks for viruses
2.C.3.b	Engineering and Technology	Knowledge	29%	Install a door lock
		05 Engineering, Technology, Production and Processing	57%	Design a more stable grocery cart
			86%	Plan for the impact of weather in designing a bridge
2.C.3.c	Design	Knowledge	29%	Draw a straight line 4 3/16 inches long
		02 Arts and Humanities	57%	Draw plans for remodeling a kitchen
			86%	Develop detailed plans for a high-rise office building
2.C.3.d	Building and Construction	Knowledge	29%	Choose the proper type of wood for adding a deck onto a house
		05 Engineering, Technology, Production and Processing	57%	Fix a plumbing leak in the ceiling
			86%	Build a high-rise office tower
2.C.3.e	Mechanical	Knowledge	29%	Replace the filters in a furnace
		05 Engineering, Technology, Production and Processing	57%	Replace a valve on a steam pipe
			100%	Overhaul an airplane jet engine
2.C.4.a	Mathematics	Knowledge	14%	Add two numbers
		04 Sciences, Mathematics and Computers	57%	Analyze data to determine areas with the highest sales
			86%	Derive a complex mathematical equation
2.C.4.b	Physics	Knowledge	14%	Use a crowbar to pry open a box
		04 Sciences, Mathematics and Computers	57%	Calculate water pressure through a pipe
			86%	Design a cleaner burning gasoline engine

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2.C.4.c	Chemistry	Knowledge	29%	Use a common household bug spray
		04 Sciences, Mathematics and Computers	57%	Use the proper concentration of chlorine to purify a water source
			86%	Develop a safe commercial cleaner
2.C.4.d	Biology	Knowledge	14%	Feed domestic animals
		04 Sciences, Mathematics and Computers	71%	Investigate the effects of pollution on marine plants and animals
			100%	Isolate and identify a new virus
2.C.4.e	Psychology	Knowledge	29%	Monitor several children on a playground
		03 Social sciences, Economy and Law	57%	Understand the impact of alcohol on human responses
			86%	Treat a person with severe mental illness
2.C.4.f	Sociology and Anthropology	Knowledge	29%	Identify two cultures in a story as being different
		03 Social sciences, Economy and Law	71%	Write a pamphlet about cultural differences
			100%	Create a new theory about the development of civilizations
2.C.4.g	Geography	Knowledge	29%	Know the capital of the United States
		04 Sciences, Mathematics and Computers	57%	Identify Turkey on a world map
			86%	Develop a map of the world showing mountains, deserts, and rivers
2.C.5.a	Medicine and Dentistry	Knowledge	14%	Use a band-aid
		06 Helath services	71%	Fill a tooth cavity
			100%	Perform open heart surgery
2.C.5.b	Therapy and Counseling	Knowledge	29%	Put ice on a sprained ankle
		06 Helath services	57%	Provide job counseling to the unemployed
			86%	Counsel an abused child
2.C.6	Education and Training	Knowledge	29%	Show someone how to bowl
		01 Education and Training	57%	Lead a quality improvement seminar
			86%	Design a training program for new employees
2.C.7.a	English Language	Knowledge	29%	Write a thank you note
		02 Arts and Humanities	57%	Edit a feature article in a local newspaper
			86%	Teach a college English class
2.C.7.b	Foreign Language	Skills	14%	Say "please" and "thank you" in a foreign language
		04 Comunication in foreign languages	43%	Ask directions in a foreign city
			71%	Write an English language review of a book written in a foreign language
2.C.7.c	Fine Arts	Knowledge	14%	Attend a popular music concert
		02 Arts and Humanities	43%	Play a minor part in a local theater play
			71%	Design an artistic display for a major trade show
2.C.7.d	History and Archeology	Knowledge	43%	Take a class in US history
		02 Arts and Humanities	57%	Teach local history to school children
			86%	Determine the age of bones for placing them in fossil history
2.C.7.e	Philosophy and Theology	Knowledge	29%	Watch a TV program on family values
		02 Arts and Humanities	57%	Understand another culture's religious practices
			86%	Compare the teachings of major philosophers
2.C.8.a	Public Safety and Security	Knowledge	14%	Use a seatbelt
		07 Services	57%	Inspect a building site for safety violations
			86%	Command a military operation
2.C.8.b	Law and Government	Knowledge	29%	Register to vote in a national election
		03 Social sciences, Economy and Law	57%	Prepare documents and title papers for the purchase of a new house
			86%	Serve as a judge in a federal court
2.C.9.a	Telecommunications	Knowledge	14%	Dial a phone
		07 Services	29%	Install a satellite TV dish
			100%	Develop a new, world-wide telecommunications network
2.C.9.b	Communications and Media	Knowledge	29%	Write a thank you note
		02 Arts and Humanities	57%	Be a radio disk jockey
			71%	Write a novel
4.A.1.a.1	Getting Information	Skills	29%	Follow a standard blueprint
		02 Practical skills	57%	Review a budget
			86%	Study international tax laws
4.A.1.a.2	Monitor Processes, Materials, or Surroundings	Skills	29%	Check to see if baking bread is done
		02 Practical skills	57%	Test electrical circuits
			86%	Check the status of a patient in critical medical care
4.A.1.b.1	Identifying Objects, Actions, and Events	Skills	29%	Test an automobile transmission
		02 Practical skills	57%	Judge the acceptability of food products
			86%	Determine the reaction of a virus to a new drug
4.A.1.b.2	Inspecting Equipment, Structures, or Material	Skills	14%	Check that doors to building are locked
		02 Practical skills	57%	Inspect equipment in a chemical processing plant
			86%	Inspect a nuclear reactor
4.A.1.b.3	Estimating the Quantifiable Characteristics of	Skills	29%	Estimate the size of household furnishings to be crated
		02 Practical skills	57%	Estimate the time required to evacuate a city in the event of a major disaster
			86%	Estimate the amount of natural resources that lie beneath the world's oceans

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4.A.2.a.1	Judging the Qualities of Things, Services, or People	Skills	29%	Determine whether to remove a tree that has been damaged
		01 Cognitive skills	57%	Determine the value of property lost in a fire
			86%	Establish the value of a recently discovered ancient art work
4.A.2.a.2	Processing Information	Skills	29%	Tabulate the costs of parcel deliveries
		01 Cognitive skills	57%	Calculate the adjustments for insurance claims
			86%	Compile data for a complex scientific report
4.A.2.a.3	Evaluating Information to Determine Compliance	Skills	14%	Review forms for completeness
		01 Cognitive skills	57%	Evaluate a complicated insurance claim for compliance with policy terms
			86%	Make a ruling in court on a complicated motion
4.A.2.a.4	Analyzing Data or Information	Skills	14%	Determine the location of a lost order
		01 Cognitive skills	57%	Determine the interest cost to finance a new building
			86%	Analyze the cost of medical care services for all hospitals in the country
4.A.2.b.1	Making Decisions and Solving Problems	Skills	29%	Determine the meal selection for a cafeteria
		01 Cognitive skills	57%	Select the location for a major department store
			86%	Make the final decision about a company's 5-year plan
4.A.2.b.2	Thinking Creatively	Competence	14%	Change the spacing on a printed report
		01 Personal abilities	57%	Adapt popular music for a high school marching band
			86%	Create new computer software
4.A.2.b.3	Updating and Using Relevant Knowledge	Skills	29%	Keep up with price changes in a small retail store
		01 Cognitive skills	57%	Keep current on changes in maintenance procedures for repairing sports cars
			86%	Learn information related to a complex and rapidly changing technology
4.A.2.b.4	Developing Objectives and Strategies	Competence	29%	Plan the holiday schedule for an airline workforce
		03 Methodical abilities	57%	Develop the plan to complete the merger of two organizations over a 3-year period
			86%	Develop a 10-year business plan for an organization
4.A.2.b.5	Scheduling Work and Activities	Competence	29%	Make appointments for patients using a predetermined schedule
		03 Methodical abilities	57%	Prepare the work schedule for salesclerks in a large retail store
			86%	Schedule a complex conference program with multiple, parallel sessions
4.A.2.b.6	Organizing, Planning, and Prioritizing Work	Competence	29%	Organize a work schedule that is repetitive and easy to plan
		03 Methodical abilities	57%	Plan and organize your own activities that often change
			86%	Prioritize and plan multiple tasks several months ahead
4.A.3.b.1	Interacting With Computers	Skills	29%	Enter employee information into a computer database
		02 Practical skills	57%	Write software for keeping track of parts in inventory
			86%	Set up a new computer system for a large multinational company
4.A.3.b.2	Drafting, Laying Out, and Specifying Technical Devices,	Skills	29%	Specify the lighting for a work area
		02 Practical skills	57%	Specify the furnishings for a new school
			86%	Draw the electronic circuitry for a high-speed scientific computer
4.A.3.b.4	Repairing and Maintaining Mechanical	Skills	29%	Make simple, external adjustments to a door hinge with ordinary hand tools
		02 Practical skills	57%	Adjust a grandfather clock
			86%	Overhaul a power plant turbine
4.A.3.b.5	Repairing and Maintaining Electronic Equipment	Skills	14%	Use knobs to adjust a television picture
		02 Practical skills	57%	Make repairs by removing and replacing circuit boards
			86%	Use complex test equipment to calibrate electronic equipment
4.A.3.b.6	Documenting/Recording Information	Skills	29%	Record the weights of trucks that use the highways
		02 Practical skills	57%	Document the results of a crime scene investigation
			86%	Maintain information about the use of orbiting satellites for private industry communications
4.A.4.a.1	Interpreting the Meaning of Information for Others	Skills	14%	Interpret a blood pressure reading
		03 Communication in the mother language	57%	Interpret how foreign tax laws apply to U.S. exports
			86%	Interpret a complex experiment in physics for general audiences
4.A.4.a.2	Communicating with Supervisors, Peers, or Subordinates	Skills	14%	Write brief notes to others
		03 Communication in the mother language	57%	Report the results of a sales meeting to a supervisor
			86%	Create a videotaped presentation of a company's internal policies
4.A.4.a.3	Communicating with Persons Outside Organization	Skills	14%	Have little contact with people outside the organization
		03 Communication in the mother language	57%	Make standard presentations about available services
			86%	Prepare or deliver press releases
4.A.4.a.4	Establishing and Maintaining Interpersonal Relationships	Competence	14%	Exchange greetings with a coworker
		02 Social abilities	57%	Maintain good working relationships with almost all coworkers and clients
			100%	Gain cooperation from a culturally diverse group of executives hostile to your company
4.A.4.a.5	Assisting and Caring for Others	Competence	29%	Help a coworker complete an assignment
		02 Social abilities	57%	Assist a stranded traveler in finding lodging
			86%	Care for seriously injured persons in an emergency room
4.A.4.a.6	Selling or Influencing Others	Competence	14%	Convince a coworker to assist with an assignment
		02 Social abilities	57%	Deliver standard arguments or sales pitches to convince others to buy popular products
			86%	Deliver major sales campaign in a new market
4.A.4.a.7	Resolving Conflicts and Negotiating with Others	Competence	29%	Apologize to a customer who complains about waiting too long
		02 Social abilities	57%	Get two subordinates to agree about vacation schedules
			100%	Negotiate a major labor-management contract
4.A.4.a.8	Performing for or Working Directly with the Public	Skills	14%	Tend a highway toll booth
		03 Communication in the mother language	57%	Sell shoes in a popular shoe store
			86%	Perform a monologue on national TV

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4.A.4.b.1	Coordinating the Work and Activities of Others	Competence	29%	Exchange information during a shift change
		03 Methodical abilities	57%	Organize the cleanup crew after a major sporting event
			100%	Act as general contractor for building a large industrial complex
4.A.4.b.2	Developing and Building Teams	Competence	14%	Encourage two coworkers to stick with a tough assignment
		03 Methodical abilities	57%	Lead an assembly team in an automobile plant
			86%	Lead a large team to design and build a new aircraft
4.A.4.b.3	Training and Teaching Others	Competence	29%	Give coworkers brief instructions on a simple procedural change
		03 Methodical abilities	57%	Teach a social sciences course to high school students
			86%	Develop and conduct training programs for a medical school
4.A.4.b.4	Guiding, Directing, and Motivating Subordinates	Competence	29%	Work occasionally as a backup supervisor
		03 Methodical abilities	57%	Supervise a small number of subordinates in a well-paid industry
			100%	Manage a severely downsized unit
4.A.4.b.5	Coaching and Developing Others	Competence	29%	Show a coworker how to operate a piece of equipment
		03 Methodical abilities	57%	Provide on-the-job training for clerical workers
			86%	Coach a college athletic team
4.A.4.b.6	Provide Consultation and Advice to Others	Competence	14%	Work in a position that requires little advising of others
		03 Methodical abilities	57%	Recommend a new software package to increase operational efficiency
			100%	Provide ideas for changing an organization to increase profitability
4.A.4.c.2	Staffing Organizational Units	Competence	14%	Work in a position that has minimal staffing requirements
		03 Methodical abilities	57%	Interview candidates for a sales position and make hiring recommendations
			100%	Direct a large recruiting and employment program for a large international manufacturing organization
4.A.4.c.3	Monitoring and Controlling Resources	Competence	29%	Work as a housekeeper responsible for keeping track of linens
		03 Methodical abilities	57%	Work as a chef responsible for ordering food for the menu
			86%	Serve as a financial executive in charge of a large company's budget