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# Towards European skill needs forecasting

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Alena Zukersteinova
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(eds)

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# Foreword

There has been a lack of information on future skill needs in Europe for a long time. Requests for information have been repeatedly coming to Cedefop and other European organisations. The European labour market is becoming a reality on the European Union (EU) policy agenda and the free movement of labour gives hope that increased mobility across European countries will help to reduce unemployment. At the same time, occupations, skills, competences and qualifications, which will be required on the European labour market in future, have not been identified. The need to anticipate skills and occupational needs were defined as a priority in the *Maastricht communiqué* ([1]), in the *European Council's integrated guidelines for employment* for 2005-08 (2) (guidelines Nos 19, 20 and 24), and in the Social partners' framework of actions *for the lifelong development of competencies and qualifications* ([3]).

To find ways of obtaining information on future skill needs in Europe – even a joint European action – has become a main concern.

An expert workshop looking at the feasibility of European skill needs forecasting was held in Cyprus in October 2005. The workshop was jointly organised by Cedefop and its international network on early identification of skill needs Skillsnet, the Human Resource Development Authority (HRDA) of Cyprus and the Research Centre for Education and the Labour Market (ROA) of Maastricht University. The workshop aimed at exploring different approaches, data availability and compatibility of classifications in individual Member States to reach agreement on principal methodology of European skill needs forecasting.

Without doubt, forecasting skill needs and demand at macro level has several limitations – for example, reliability and level of detail of output, lack of information on skills gaps and competence requirements in the workplace. Nevertheless, due to relatively low costs, if based on a common methodology and standardised statistics, (econometric) skill forecasting at European level could be feasible in the near future and could become an important information contribution for evidence-based policies. Alternative methods, such as employers' surveys, scenarios, and other 'softer' methods – possibly combined with quantitative forecasting – are equally relevant, but given their relatively high costs and non-standardised approach, remain a task for the more distant future.

To ensure better comparability of the information provided by Member States for the workshop, Cedefop's Skillsnet team created a template with questions focused on methods, models, data sources and classifications of forecasting approaches at national level (the full text of the template is available in annex). Experts in forecasting occupations, skills and educational fields from 14 European countries (Austria, Cyprus, the Czech Republic, Estonia, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Poland, Romania and the UK) were asked to submit papers based on the template and subsequently to present them at the workshop.

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([1]) Available from Internet: http://ec.europa.eu/education/policies/2010/vocational_en.html [cited 5.9.2006].

([2]) Available from Internet: http://eur-lex.europa.eu/LexUriServ/site/en/oj/2005/l_205/l_20520050806en00210027.pdf [cited 5.9.2006].

([3]) Available from Internet: http://www.etuc.org/a/580 [cited 5.9.2006].

This publication is based on the proceedings of this workshop and presents potential opportunities and obstacles for European skill needs forecasting. The publication is divided into three parts. The first part looks at feasibility of the approach and summarises previous efforts to create pan-European skills forecasts and at classifications, data and models essential for European skill needs forecasting. The second part presents the information input provided by Member States according to Cedefop's template. Finally, the third part presents a summary of the information input by Member States and conclusions.

The idea to launch European skill needs forecasting was approved by all participants and Cedefop received a clear mandate to continue this initiative and to coordinate further steps. We would like to take this opportunity to thank all participants, contributors and organising institutions for their work and their enthusiasm and interest in contributing to the success of this workshop and to developing such an important tool as a European skill needs forecasting system.

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# Part I

# Is European skill needs forecasting feasible?

# Pan-European skills forecasts

*Rob Wilson and Robert Lindley, Institute for Employment Research (IER)*

## 1. Introduction

### 1.1. Overview

This paper examines previous attempts at forecasting occupational employment across Europe. It goes on to explore the feasibility of developing a pan-European system to help identify future skill needs using currently available data and models. It includes a brief review of forecasting models used across the world as a whole, as well as an assessment of the suitability of existing data and models for identifying future skill needs/requirements consistently across all European countries.

The review suggests that best practice in anticipating changing skill requirements, worldwide, usually involves the development of quantitative, national level employment projections, based on the use of a multisectoral macroeconomic model. Although other methods and approaches are often adopted, these are generally regarded as complementary rather than substitutes for such projections, which are a cornerstone of most countries' efforts to provide useful labour-market information to the various actors and stakeholders in the labour market.

Use of a multisectoral macroeconomic modelling approach brings various advantages, as set out below. While this is not the sole tool required to anticipate future skill needs, it is regarded as an essential part of the armoury in most countries that undertake this kind of activity. The review suggests that there is the modelling capability upon which a robust, pan- European, multisectoral forecasting system for occupational employment forecasting can be developed. There are already some useful data to build such models, although these are not without limitations. There are real concerns about the quality of some of the data in some countries, and these need to be improved, but this should not preempt development of a new cross-national level, employment forecasting tool.

Specific recommendations on how to move forward are made. Most countries already have in place many of the building blocks required to carry out such a project. Moreover, there is already at least one detailed multisectoral macroeconomic model covering the EU-15 Member States plus Norway and Switzerland. This is currently being extended to include the 10 new Member States. The key data sets providing information on occupational and qualification employment structures of employment also exist, although these do have their limitations and need to be further developed and improved if the reliability of this kind of exercise is to match that in countries which represent best practice.

It is, therefore, proposed that a regular system for making quantitative employment projections, at national level, be set in place. This should include detailed sectoral, occupational and qualification elements, including estimates of replacement demands. A modular structure is proposed, which can facilitate further development and keep costs down.

The key modules are:

module 1: a set of multisectoral macroeconomic forecasts, based on an existing model;

module 2: an occupational model, building upon previous work undertaken in many individual countries, but adopting common classifications and data sources;

module 3: a replacement demand module, based on similar data sources, recognising the crucial importance of considering not just changing occupational employment levels but also the need to replace those leaving the workforce because of retirement, migration and mortality;

module 4: a qualifications module, based on similar data sources, focusing on the implications for qualification intensities within occupations (demand) rather than the supply side.

While all four modules could be undertaken independently, in practice the data and issues involved in Modules 2 and 4 are closely interrelated and are probably best undertaken by a single research team, although there are obvious merits in drawing in expertise from each individual country at both the data collection and interpretation phases. This could be formalised by setting up a network coordinated by Cedefop, which could manage this process, as well as provide input and obtain outputs from it.

It is argued that, while there may be some benefits in new primary data collection to improve existing data, this is not a necessary condition to undertake some useful benchmark projections. These can be produced using existing data. Based on the assumption that no new primary data collection is required, the basic costs of such an exercise could be quite modest. However, there would undoubtedly be considerable scope for continuing development work and improvement, based on the bare bones proposed here.

The key elements would be:

(a) a set of multisectoral projections from an existing model;

(b) development of a robust and consistent occupational database and related projection models, including implications for replacement demands and qualifications intensities;

(c) production of a good quality report, including methodological details, software and data to enable easy updating.

Finally, the nature of the dissemination and dialogue process conducted in conjunction with producing projections needs to be carefully thought through. Essentially, the aim should be to create a 'community of practice' bringing together forecasters and professional users of their output from all over Europe. The possibilities for using telematic platforms for this purpose can be exemplified by Cedefop's existing Skillsnet as well as other examples such as the Institute for Employment Research (IER) UK 2004 launch of the national guidance research forum network, concerned with careers information, advice and guidance.

## 1.2. Background

Various attempts have been made previously to undertake cross-European skills projections. These have often floundered due to problems of incompatible data and lack of funding. It is argued below that technological developments and improvements in data availability mean the time is now ripe to develop such forecasts systematically. This would not be a substitute for what is already being done at national level. Rather it would complement this, offering for the first time a broad overview of the whole of Europe. While this might not be able to

compete with what is being done for individual countries (which is based on many years of investment in data, systems and knowledge), it would provide a common framework within which these more detailed analyses could be compared.

Anticipating the conclusions of this review, it is clear that best practice worldwide involves use of large-scale multisectoral models to produce a comprehensive overview of how structural economic and technological changes are affecting the demand for skills. The development and use of such models is a resource-intensive process, and it is apparent it is not a practical objective to develop new macroeconomic models.

What is possible is to:

(a) assess the feasibility of using existing macro and sectoral models, already available at European level, to drive an overarching set of projections covering all sectors of the economy;

(b) assess the availability and reliability of currently available data on occupational employment structure by industry, including most importantly the common labour force surveys (LFS);

(c) developing estimates of 'replacement' demand by occupation, including elements such as:
   (i) voluntary retirements from the workforce,
   (ii) mortality,
   (iii) migration.

(d) extending this work to include other aspects/dimensions of skill such as formal educational and training qualifications. Problems of classification comparability across countries may be most severe here, but if restricted to broad levels of education this is unlikely to be critical.

### 1.3. Structure

Section 2 begins with a brief review of the various methods used across the world to anticipate changing skill needs worldwide, with particular emphasis on quantitative occupational employment forecasting. All the key approaches are considered, including the national, multisectoral, macro modelling approach. The reasons for favouring the latter approach are set out in detail, along with some of the problems and pitfalls associated with it.

Section 3 reviews previous work on occupational employment across Europe in which IER has been involved. The discussion provides some brief reflections on this experience.

Section 4 assesses briefly the key data sources, focusing on their strengths and weaknesses from the point of view of developing a systematic and comprehensive quantitative forecasting tool. This includes issues such as the quality of sectoral employment and occupational employment data, as well as a review of a multicountry macroeconomic forecasting model which could be used to drive such projections. Data on 'replacement demands' by occupation, including rates of outflow due to normal retirement, mortality and net migration, and data on qualifications are also considered.

Section 5 presents some conclusions and recommendations.

# 2. An overview of occupational forecasting worldwide

## 2.1. Key approaches: an assessment of international best practice

There have been a large variety of approaches to anticipating changing skill needs worldwide. These have tended to reflect perceptions of both what is desirable, as well as the practical limitations of what is feasible. Both of these have changed substantially over the past 50 years.

From the earliest attempts, those engaged in such work have adopted model-based, quantitative methods wherever possible, simply because quantitative results have been seen as a key output required by potential users of the results. The use of formal models has been advocated on various grounds, as detailed below. However, the merit of alternative, more qualitative methods has also been recognised.

Current work is still much constrained by data limitations. What is feasible in different countries is limited by their 'statistical infrastructure'. Some countries, such as the US, have been engaged in this work for over 50 years. The sophisticated analysis conducted there has been based on substantial prior investments in statistical surveys and data sets, as well as modelling capacity. In contrast, in some other countries, where the same levels of investment have not been undertaken, the data to develop such quantitative models simply do not exist. In such cases alternative approaches have been developed. While these approaches can provide some useful insights, they are generally regarded as useful complements to the more fully-fledged, model-based projections, rather than a substitute for them.

Based on an extensive review (Wilson et al., 2004), covering most of the countries in the world which have undertaken work of this nature, the main approaches adopted include:

(a) formal, national level, quantitative, model-based projections;
(b) ad hoc sectoral or occupational studies;
(c) surveys of employers or other groups;
(d) focus groups/round tables and other Delphi style methods, including setting up 'observatories' (these may include some quantitative aspects but are generally more qualitative).

Each of these approaches has its own strengths and weaknesses. These have been compared and contrasted in Table 1. This includes the multisectoral macro modelling approach, although the pros and cons of this method are discussed in greater detail in the next subsection.

Even where forecasting is carried out using hard-nosed, quantitative methods, those involved usually stress that such projections should be seen as part of an ongoing process rather than the final word, and they recognise the importance of incorporating more qualitative insights. None of today's forecasters claim they can predict the detailed skill needs in different sectors with great quantitative precision. Rather, they suggest they can provide the various participants in the labour market, as well as policy-makers, with useful insights into how labour markets are developing in response to various external influences. It is important to recognise that accurate and precise forecasts are a chimera. The key question is not whether or not such projections are accurate, but whether or not they are useful. The revealed preferences of national governments from all over the world, who support such activity with substantial funding, suggest they are regarded as of considerable value. It is also clear such work is seen as having a wide variety of different audiences and users, including careers guidance, as well as general labour-market

policy formation and planning education and training programmes. Few, if any, countries now regard such work as resulting in information that can be used to plan the scale and pattern of education and training provision with any precision. Rather, it can help to inform all those involved about how economic and other forces are shaping labour markets and the general implications for those skills that will be required.

## 2.2. Typical quantitative modelling approaches

The typical quantitative modelling approach involves two key elements. The first key component is a multisectoral macroeconomic model of some kind, usually built around a Leontief input-output table, which considers the interlinks between sectors. Such models are usually estimated using complex and sophisticated econometric methods, although computable general equilibrium models (where parameters are imposed rather than estimated) are also used in several countries. The key outcomes as far as the present project is concerned are consistent projections of employment levels by sector. Of course, in addition to providing projections of sectoral employment, such models are used for a wide variety of other purposes.

The second key component is a module, or set of modules, which translate the outcomes from the multisectoral models into implications for the demand for skills. These elements vary considerably across countries. Most commonly, this aspect is much less sophisticated, mainly due to the more limited nature of data available on skills. In most cases, the focus of attention is limited to occupational employment structures within sectors. The trends in such structures are analysed, normally using simple techniques rather than sophisticated econometric methods.

## 2.3. Reasons for favouring a quantitative modelling approach

The review of international best practice in skills forecasting suggests that this generally involves use of a multisectoral macroeconomic model. Such models are regarded as essential to obtain a robust and consistent sectoral employment scenario, which is the starting point for any comprehensive assessment of changing skill needs.

The advantages of such an approach include:

(a) the sectoral and other detail it provides;
(b) it is typically comprehensive, covering the whole economy;
(c) logical consistency;
(d) imposition of accounting constraints;
(e) recognition of economic constraints and influences;
(f) it helps make underlying assumptions explicit;
(g) consistent scenarios across all sectors.

## 2.4. Problems and pitfalls in using a modelling approach

Such methods do, of course, have some disadvantages and problems. These relate to:

(a) data limitations (often data were not collected with modelling in mind);
(b) technical limitations within fixed resource limits;
(c) resource costs of development and maintenance;
(d) limits to current understanding of the way labour markets work;

(e) the possibly limited relevance of the past (such models being based on an assumption of a continuation of past patterns of behaviour).

Quantitative models should not, therefore, be seen as a panacea. Nevertheless, in most countries that conduct regular national assessments of future occupational and skill requirements, such models are an essential cornerstone. They are increasingly being adopted in developing, as well as developed, countries as availability of data and the capacity for model building improves.

*Table 1: Comparison of the pros and cons of alternative approaches to anticipating skill requirements*

| Alternative approaches | Advantages | Disadvantages |
|---|---|---|
| Formal, national level, quantitative, model-based projections | Comprehensive;<br>consistent;<br>transparent;<br>quantitative. | Data-hungry;<br>costly;<br>not everything can be quantified. May give a misleading impression of precision. |
| Ad hoc sectoral or occupational studies (using a variety of quantitative [model-based] and qualitative tools) | Strong on sectoral or other specifics. | Partial;<br>can be inconsistent across sectors, areas, etc. |
| Surveys of employers or other groups, asking about skill deficiencies and skill gaps | Direct user/customer involvement. | May be very subjective;<br>inconsistent;<br>can too easily focus on the margins (i.e. current vacancies) rather than skill gaps within the current workforce. |
| Focus groups/round tables-observatories and other Delphi style methods | Holistic;<br>direct user/customer involvement. | Non-systematic;<br>can be inconsistent;<br>can be subjective. |

# 3. European experience of medium-term labour-market assessments

## 3.1. The general context

Young economists fascinated by econometric estimation are sometimes captured by the notion of modelling a whole economy and testing out the impact of alternative policies, usually of a macroeconomic persuasion: taxes/subsidies, public expenditure and monetary policy. Some who are primarily interested in the labour market and skills wonder if it would not be possible to specialise in modelling those parts of the economy. To date, there is little scope for this, either as an economist, operational researcher or other social scientist, etc., in most countries. Nor are national research contracts to fund such work reasonably regularly common, despite the great emphasis placed on the importance of understanding and promoting a knowledge-based, highly skilled society with high employment rates. The professional community in this field is poorly developed.

Three basic lessons learned in forecasting, projecting or scenario-making are the importance of continuity of:

(a) sponsoring organisation,
(b) the research team,
(c) the dissemination process.

Without these three factors, the quality of commissioning, the quality of the teams deciding to bid for a given call for tenders, the quality of the work done by the selected team, and the quality of dissemination to the policy, practitioner and scientific communities are all detrimentally affected. This means that the value-for-money obtained by the sponsor and the job satisfaction received by the research team are both likely to be lower than they could be. However, the ad hoc commissioning of projection work in the labour-market field has been the dominant practice both at national level (including local and regional studies) and international level. Some countries are exceptions to this rule for some periods, but they are in a minority. Ireland, the Netherlands, the UK and the US are probably the best examples.

However, there is apparently a general professional reluctance on the part of most social scientists working within government and public agencies and in international bodies to commit to carrying out themselves, or commissioning systematically and regularly from external research organisations, labour-market assessments. Why is an interesting question of professional training and culture, particularly of economists, but to reflect on this would go beyond the scope of this paper. Moreover, it is not unusual for non-economists, indeed, non-social-scientists to be in charge of writing EU calls for tenders and of the subsequent relationship with the selected contractors' consortium. So there is a significant issue of *professionalité* in the forecasting/projection/scenario/futures field.

### 3.2. Some IER experience

Here, we briefly reflect on IER's experience of several EU-funded multicountry projects concerned with medium-term projections of the labour market. All but one (see (f) below) involved some degree of occupational/skills projections.

The institute has been involved in several major projects which have produced forecasts of the changing structure of employment in EU Member States or, in the case of the first listed, assessments of existing projections in the course of examining the early evidence on the changing nature of employment. IER's European programme, led by Robert Lindley, has been responsible for this work. A European symposium on labour market developments was organised by the University of Warwick for several years during the 1990s and 2000s. IER (Lindley and Wilson), ESRI, the Economic and Social Research Institute (Hughes) and ROA (Heike and colleagues) formed the backbone of that activity ([4]).

The principal studies and projects on producing projections and involving IER have been:

(a) *New forms and areas of employment growth* (1986-87, Germany, France, Italy, the Netherlands and the UK) (European Commission, DG V) (IER led with BIPE, IFO, SEOR);

(b) *Future employment and training perspectives for information technologies in the European Community*, including cases of business services, software services and selected manufacturing industries (1990-91, Germany, France, Italy and the UK) (European Commission, DG XIII) (IFO-led with IER and others collaborating);

([4]) In addition, considerable research has been carried out by IER, led by Peter Elias, in developing classifications of occupations and socioeconomic groups; this was commissioned by Eurostat and the ILO. At the same time the putting into practice of efficient and reliable computer assisted occupational coding was also made easier by software designed by IER to assist survey managers.

(c) *Medium-term employment forecasts for Europe* (1994, 12 Member States) (European Commission, DG V) (IFO-led with IER responsible for coordination of module dealing with occupation, gender and qualification);

(d) *Population ageing and the labour market in Europe* (1997-99, 12 Member States) (European Commission DG V) (IER-led plus 11 other institutes) (the 'PALME Study');

(e) *Employment, trade and labour costs in manufacturing* (1996-98, 12 Member States (Cambridge Econometrics led with IER covering the labour sector);

(f) *Sectoral forecasts for EU Member States* (2000-01, 12 Member States) (European Commission DG II) (Cambridge Econometrics led with IER covering technological progress and labour supply).

In most forecasting projects it has been necessary to start from scratch, even if existing models did provide a basis for simulation work at macro and sectoral levels. The population ageing project (d), for example, used:

- energy-environment-economy model for Europe (E3ME - created by Cambridge Econometrics, see the following section);
- a substantially modified and extended version of the Carnegie-funded model on the age dimension in the labour market (created by IER);
- two models of labour supply-based on microdata (created by NIDI of the Netherlands).

The second and third models were basically produced as part of the project work.

The market for European forecasting is extremely uncertain, yet one issue is the lack of established EU-economy-wide modelling capacity other than E3ME and certain general equilibrium models used in modelling trade, technology and energy. The latter, however, breech several requirements that need to be met in disaggregate economic and labour-market forecasting; not the least of these is their rather cavalier attitude to the empirical basis for their models. Project (c) was able to draw on E3ME as the basis for more detailed work at sectoral, regional and occupational levels. The teams involved in this work would not have had the confidence to use less empirically-rooted models.

Each of these studies involved to different degrees the construction of major multidimensional data sets relating to the labour market. One combined a set of existing medium-term forecasts produced at national level and sought to interpret them alongside more detailed information on the changing nature and structure of employment (a). Four used existing multisectoral macroeconomic models of the EU economy which were intended to produce commonly consistent projections (e.g. in relation to trade flows between countries and relative prices), to which were added specially constructed submodels to disaggregate the labour market further than in the main model (b, c, d and e).

In the case of (b), the study of the impact of new technology had access to the European-wide model Hermes and two teams cooperated on the project: one was led by IFO-Munich with the Warwick IER being responsible for coordinating the occupational work; the other was led by Merit and sought to modify Hermes to take special account of changes in information and communications technology, the variant of the model coming to be known as Hermit. The latter did not disaggregate by occupation.

### 3.3. Data and selection of models

One strategic issue in carrying out multicountry modelling of any kind is whether or not to use only harmonised data sets that are more or less regularly updated by international statisticians in collaboration with their national counterparts. Exploiting such data sets can be done without the need for a prior exercise in reconciling different statistical classifications, conceptual schemes and statistical methodologies. However, confining the modelling and projection exercise to working only with internationally harmonised data limits the potential of national models to what can be applied to all countries, using a data set that does not exploit richer data available for some countries if not for all of them.

Since labour-market researchers cannot be expected to model the whole economy to model the labour market, any more than national economic model builders can be expected to model the world economy to model their own, some compromises need to be made. The key options are:

(a) allow each national team to use an existing national economic model (normally constructed from data meeting standards of United Nations system of national accounts) and, where one is not already available, add to it a national labour-market module including the extensive disaggregation of labour services – for example, industrial branch, occupation, employment status, gender, age;

(b) use an existing multicountry multisectoral model and limit the additional work to creating a submodel for each country which, typically, disaggregates employment by whichever of the above dimensions have yet to be incorporated. Normally, this would involve no feedback to the main model and can, therefore, be carried out independently. Ideally, there would, of course, be some feedback via impacts on the rate of technical progress, productivity and labour costs;

(c) use an existing multicountry multisectoral model and invest in fully embedding a disaggregated labour sector using the same general model specification for each country. The latter could be very simple to begin with but ultimately may allow, for those countries with much better data, the production of labour sector models with more behavioural content (e.g. wage-sensitivity of labour demand, productivity as a function of investment in human as well as physical capital).

### 3.4. Dialogue – the effective exploitation of model output

The potential relationship between model-produced forecasts or scenarios and the insights offered from: the output of other models that may differ in methodology; from a more limited treatment of the economy (e.g. a particular sector); or from more qualitative evidence of the prospects for change, is discussed in Lindley (2003).

Essentially, emphasis is placed on the nature of the dialogue taking place around the models results. This depends on the principal interests and levels of expertise among the group exploring a set of forecasts. It depends on whether or not it is intended that learning among the group will include the time for, and a willingness to engage in, iterative modification of the model-based forecast.

Various approaches can be adopted to sharing projections with the policy and practitioner communities, as well as other experts on general economics, sectoral specifics, labour-market situations and educational change. How this part of the process is handled is as important as how the more technical issues of data and modelling are settled.

Essentially, the principal issue is: what kind of community of practice is being created to embed as effectively as policy the potential insights from the projections within the wider policy and practitioner communities?

# 4. Existing models and data sources

## 4.1. Multisectoral macroeconomic models at European level

Most countries have some macroeconomic modelling work at national level and in many cases this includes multisectoral and multiregional subcomponents. There have been a few attempts to develop cross country models. Perhaps the most widely used is E3ME. Much of the following discussion in this section is taken direct from the E3ME website ([5]).

The E3ME was built by a European team under the EU Joule/Thermie programme as a framework for assessing energy-environment-economy issues and policies. The model has been used for general macro analysis and for more focused analysis of policies relating to greenhouse gas mitigation, incentives for industrial energy efficiency and sustainable household consumption. Its pan-European coverage is appropriate for an increasingly integrated European market. E3ME provides a one-model approach in which detailed industry analysis is consistent with macro analysis: in E3ME, the key indicators are modelled separately for each sector, and each region, yielding the results for Europe as a whole.

The model provides:

(a) annual comprehensive forecasts to the year 2020:
   (i) for 19 European regions including EU-15 (plus north and south Italy and east and west Germany), Norway and Switzerland;
   (ii) for industry output, investment, prices, exports, imports, employment and intermediate demand at a 41 industry level including 16 service industries;
   (iii) for consumers expenditure in 28 categories;

(b) full macro top-down and industrial bottom-up simulation analysis of the economy, allowing industrial factors to influence the macro picture;

(c) an in-depth treatment of changes in the input-output structure of the economy over the forecast period to incorporate the effects of technological change, relative price movements and changes in the composition of each industry's output;

(d) dynamic multiplier analysis, illustrating the response of the main economic indicators, industrial outputs and prices to standard changes in assumptions, for example changes in world oil prices, income taxes, government spending and exchange rates;

(e) scenario analysis, across a range of greenhouse gas mitigation policies, including carbon taxes and permit trading.

E3ME is intended to meet an expressed need by researchers and policy-makers for a framework for analysing the implications of long-term energy-environment-economy (E3) policies, especially those concerning research and development (R&D) and environmental taxation and regulation. The model is also capable of addressing the short-term and medium-term economic

([5]) Available from Internet: http://www.camecon.com/e3me/ [cited 16.8.2006].

effects as well as, more broadly, the long-term effects of such policies. To date, it has only been used intermittently to look at skills issues.

Most conventional macroeconomic models which are operational in government describe short and medium-term economic consequences of policies but with limited treatment of long-term effects, such as those from the supply side of the labour market, and this limits their ability to analyse long-term policies. In contrast, computable general equilibrium (CGE) models have been widely used to analyse long-term E3 policies. CGE models specify explicit demand and supply relationships and enforce market clearing, and are, therefore, seen as desirable characterisations of long-term outcomes in which markets are assumed to be in equilibrium; for this reason they have been developed particularly in the US for analysing environmental regulation. However, CGE models are not generally estimated by time-series econometric methods and they have not typically been subjected to rigorous historical validation, either in terms of the values of the model's parameters or, more broadly, the underlying assumptions with respect to economic behaviour. They also typically tend to impose the dynamics of the model solution, and so cannot be used for historical validation of the overall model; analysing short- and medium-term impacts of policy changes, meanwhile, tends to arise from the assumptions inherent in the model. Their use in forecasting or scenario projections is, therefore, more limited. Thus, CGE models are not necessarily the most appropriate vehicle for understanding the process of dynamic adjustments and structural change at sectoral level.

E3ME combines the features of an annual short- and medium-term sectoral model estimated by formal econometric methods with the detail and some of the methods of the CGE models, providing analysis of the movement of the long-term outcomes for key E3 indicators in response to policy changes. It is essentially a dynamic simulation model estimated by econometric methods.

### *4.1.1. The E3ME method: long-term equations and short-term dynamic estimation*

The econometric model, in contrast with some macroeconomic models currently in operation, has a complete specification of the long-term solution in the form of an estimated equation which has long-term restrictions imposed on its parameters. Economic theory, for example the recent theories of endogenous growth, informs the specification of the long-term equations and hence properties of the model; dynamic equations which embody these long-term properties are estimated by econometric methods to allow the model to provide forecasts. The method utilises developments in time-series econometrics, with the specification of dynamic relationships in terms of error correction models (ECM) which allow dynamic convergence to a long-term outcome. This is, therefore, a relatively ambitious modelling project which expands the methodology of long-term modelling to incorporate developments both in economic theory and in applied econometrics, while at the same time maintaining flexibility and ensuring that the model is operational.

E3ME is a detailed model of the 25 NACE-Clio sectors expanded to 41 sectors with the disaggregation of energy and environment industries, in which energy-environment-economy interactions are central. The model is designed to be estimated and solved for 19 regions of Europe chosen for the project (the EU-15 Member States plus Norway and Switzerland, with Germany divided into east and west and Italy divided into north and south), although eastern Germany is excluded from the econometric estimation.

This one-model approach is distinguished from the multimodel approach, which is a feature of earlier model-based research for the EU. In principle, linked models (such as the DRI or the Hermes-Midas system of models) could be estimated and solved consistently for all the economies involved. However, in practice, this often proves difficult, if not impossible, and considerable resources have to go into linking. Even if the consistency problem in linkage can be solved by successive iterative solutions of the component models, there remains a more basic problem with the multimodel approach if it attempts to combine macroeconomic models with detailed industry or energy models. The problem is that the system cannot adequately tackle the simulation of bottom-up policies. Normally these systems are first solved at macroeconomic level, then results for the macroeconomic variables are disaggregated by an industry model. However, if the policy is directed at the detailed industry level (say, a tax on the carbon content of energy use), it is very difficult (without substantial intervention by the model operator) to ensure that the implicit results for macroeconomic variables from the industry model are consistent with the explicit results from the macro model. As an example, it is difficult to use a macro industry two-model system to simulate the effect of exempting selective energy-intensive industries from the carbon/energy tax.

The main endogenous variables in E3ME are determined from functions estimated on historical data on European energy use and the economy. There are relatively few variables (for example energy demand by fuel user by region, matrix FR0) for which stochastic functions are estimated; around 22 in all. However, these variables may well be disaggregated in two dimensions (there are 17 fuel users and 19 regions) and IDIOM allows up to 10 alternative functional forms to explain each disaggregated category.

The econometric techniques used to specify the functional form of the equations are the concepts of cointegration and error-correction methodology.

In brief, the process involves two stages. The first stage is a levels relationship, whereby an attempt is made to identify the existence of a cointegrating relationship between the chosen variables, selected on the basis of economic theory and a priori reasoning, for example for employment demand the list of variables contains real output, real wage costs, hours worked, a composite real energy price and a measure of technological progress.

If a cointegrating relationship exists, then the second stage regression is known as the error-correction representation, and involves a dynamic first-difference regression of all the variables from the first stage, along with lags of the dependent variable, lagged differences of the exogenous variables, and the error-correction term (the lagged residual from the first stage regression). Due to limitations of data size, however, only one lag of each variable is included in the second stage.

Stationarity tests on the residual from the levels equation are performed to check whether a cointegrating set is obtained. A more efficient way of estimating the relationships would be by estimating a cointegrating vector-autoregressive models and then imposing cross-equation restrictions to ensure consistency in the equations. The size of the model poses logistical problems, but it is to be a topic of further research. For both regressions, the estimation technique used is instrumental variables, principally because of the simultaneous nature of many of the relationships, for example wage, employment and price determination.

### *4.1.2. Comparative advantages of E3ME*

Compared to other models targeted at achieving the same goals, the advantage of the E3ME lies in three areas:

model disaggregation: the detailed nature of the model allows it to represent fairly complex scenarios, in particular scenarios which are differentiated according to sector and to country. Similarly, the impact of any measure can be represented in detail;

econometric pedigree: the econometric grounding of the models gives it a better capability in representing and forecasting performance in the short to medium run. It, therefore, provides information which is closer to the time horizon of many policy-makers than pure CGE models;

E3 links: an interaction (two-way feedback) between the economy, energy demand/supply and environmental emissions is an undoubted advantage over other models which may either ignore the interaction completely or only assume a one-way causation.

In summary, the characteristics of E3ME are such that the model is:

(a) elaborated at European rather than at national level, with the national economies being treated as regions of Europe;

(b) dealing with energy, the environment, population and the economy in one modelling framework;

(c) designed from the outset to address issues of central importance for economic, energy and environmental policy at European level;

(d) capable of providing short- and medium-term economic and industrial forecasts for business and government;

(e) based on a system of dynamic equations estimated on annual data and calibrated to recent outcomes and short-term forecasts;

(f) capable of analysing long-term structural change in energy demand and supply and in the economy;

(g) focused on the contribution of research and development, and associated technological innovation, on the dynamics of growth and change.

### *4.1.3. Classifications used in E3ME*

One characteristic of the European system of account (ESA) and E3ME30 is the disaggregation of economic variables. The main classifications, follow the order of accounts in *European System of Accounts* (Eurostat, 1996). These are displayed in a compressed form for convenience on the E3ME site ([6]).

([6]) Available from Internet: http://www.camecon.com/e3me/pdf%20files/classifications_table.PDF The main 41 product/activity classification for E3ME is defined in terms of the official NACE Rev. 1 classification. http://www.camecon.com/e3me/pdf%20files/Table5n4_E3ME%20industries%20defined.pdf [cited 16.8.2006].

*Table 2: E3ME classifications*

| Classification | Name | Number of categories |
|---|---|---|
| A | World areas | 10 |
| C | Consumers' expenditure | 28 |
| E | Employment | 6 |
| G | Government spending | 5 |
| H | Institutional sectors | 11 |
| J | Fuel types | 11 |
| K | Investment sectors | 42 |
| M | Import group | 6 |
| R | Receipts and payments | 34 |
| T | Indirect taxes | 10 |
| V | Investment assets | 6 |
| Y | Industries | 41 |
| RZ | 'Regions' | 19 |

Further details for classifications E, Y and RZ are as follows:

**E Employment**

1 Male employees (FT)
2 Male employees (FT)
3 Male employees (PT)
4 Female employees (PT)
5 Male self-employed
6 Female self-employed

**RZ Regions**

1 Belgium (BE)
2 Denmark (DK)
3 Germany (east) (DO)
4 Germany (west) (DW)
5 Greece (EL)
6 Spain (ES)
7 France (FR)
8 Ireland (IR)
9 Italy (north) (IN)
10 Italy (south) (IS)
11 Luxembourg (LX)
12 Netherlands (NL)
13 Portugal (PO)
14 United Kingdom (UK)
15 Austria (AT)
16 Finland (FI)
17 Sweden (SE)
18 Norway (NO)
19 Switzerland (CH)

**Y Industries**

1 Agriculture, etc.
2 Non-energy mining
3 Water supply
4 Gas distribution
5 Electricity, etc.
6 Coal
7 Oil and gas extraction
8 Manufactured fuels
9 Food, drink and tobacco
10 Textile, clothes and footwear
11 Wood and paper
12 Printing and publishing
13 Pharmaceuticals
14 Chemicals nes
15 Rubber and plastic products
16 Non-metallic min. products
17 Basic metals, etc.
18 Metal products
19 Machinery, etc.
20 Electronics
21 Electrical goods
22 Motor vehicles
23 Other transport equipment
24 Other manufactures
25 Construction
26 Wholesale distribution
27 Retailing
28 Hotels and restaurants
29 Land transport
30 Water transport
31 Air transport
32 Ancillary transport
33 Communications
34 Financial services
35 Computing services
36 Other business services
37 Other market services
38 PAD
39 Education
40 Health and social work
41 Unallocated

## 4.2. Data on occupational structure

Most occupational projections at national level rely on use of data from censuses of population because they normally provide the largest sample of data on occupational employment cross-classified by industry and occupation (SIC-SOC matrices) ([7]). Such data could be used in a pan-European comparative exercise. The main difficulty is that censuses are only conducted infrequently (typically once every 10 years). They are also not synchronised across countries. Moreover, there are still significant differences in the questions posed, systems of classification used, etc.

The LFS, conducted in most countries as part of their obligations to the EU, provide an alternative source of such SIC-SOC matrices. They have the advantage of being conducted much more frequently. They also adopt much more standardised sets of questions and systems of classification. While there are still some differences across countries, this provides a broadly consistent set of data which can be used for producing occupational employment projections within the industries identified in macroeconomic models such as E3ME.

For example, Livanos (2005) provides details of how the LFS for Greece can be used for this purpose. The Greek LFS provides data on both industry and occupation compatible with NACE (statistical classification of economic activities in the EU) and ISCO (international standard classification of occupations).

## 4.3. Other data

### *4.3.1. Replacement demand*

In addition to changes in overall occupational employment levels it is important to consider replacement demand arising from retirements, net migration, movement into other occupations and in-service mortality. Estimating replacement demand is not straightforward and is quite sensitive to the data sources used.

Estimation of replacement demands requires the following information:

(a) data on the age and gender structure of occupational employment;
(b) data on the rates of outflow due to:
    (i) retirement (and other reasons for leaving the workforce);
    (ii) emigration;
    (iii) interoccupational mobility;
    (iv) mortality.

Information on the age and gender structure is required because many of the flows, especially retirements and mortality, are age and gender specific. Age structures vary significantly by occupation. Differences in age structure across occupations will clearly influence exits, with more older people retiring, but more younger people changing occupations. Age structure also affects mortality.

([7]) SIC: Standard industrial classification – SOC: Standard occupational classification.

From the LFS, it is possible to analyse the demographic composition of each occupation. This makes it possible to estimate specific rates of retirement and mortality for each occupational class. LFS data can also be used for making estimates of rates of outflow, again using the case of Greece as an example, the Greek LFS includes data on age structures, and qualification (based on 8 levels of education corresponding to the international standard classification of education – ISCED).

For the purposes of modelling retirements, it may be helpful to consider the fraction of the occupational class that is aged 55 to 65 (say) in a given year and then to assume that some fraction of this group would retire each year. A fairly wide age category is needed since the samples are quite small in most cases. It might also be possible to measure retirement flows over time, although this kind of approach could suffer because of the sampling errors being too large.

Occupational employment patterns are only one way of measuring skill. From the point of view of training and especially formal educational planning, the types of qualifications typically required are also important. Some (but not all) countries include a qualification dimension in their quantitative projections. Review of the data available suggests that it is possible to create employment matrices by occupation cross-classified by qualification from the LFS.

Even with only weak data for qualifications it is probably worth developing some extension to the 'replacement demand' module, which allows some inferences to be made about implications for qualifications. Alternatively some supplementary information on typical qualification structures in particular occupations might be provided to enable users of such results to draw their own conclusions about what this might mean for the demand for formal qualifications. Ideally, this would be extended to include a much more comprehensive and explicit analysis of the supply side. However, initially this is probably a bridge too far given current data limitations in many countries.

### *4.3.2. A modular approach to developing a system for producing pan-European skills projections*

It is possible to provide a detailed 'blueprint' or technical specification of how existing models and data can be exploited to provide the kind of forecasting tool required. Essentially, a modular approach is proposed with the following structure and broad elements (Figure 1).

Module 1 – Multisectoral macroeconomic model: this requires a multisectoral macroeconomic model. Given the substantial investments required to develop such a model, it is proposed that this should be based on one of the models already being used for such work, rather than trying to develop something specifically for this purpose. For example, E3ME, as described above, would provide a suitable platform.

Module 2 – Occupational model: this would be a new pan-European model, which would need to be developed as part of this new system. It would be based on various existing sources of data, especially individual country LFS. Initially, this module would simply work out the implications for occupational employment of the projected sectoral employment levels developed from Module 1 using very basic models. In the longer term, these aspects of changing economic structure could be refined, including the development of more sophisticated econometric models as well as embedding these within E3ME (including allowance for feedback

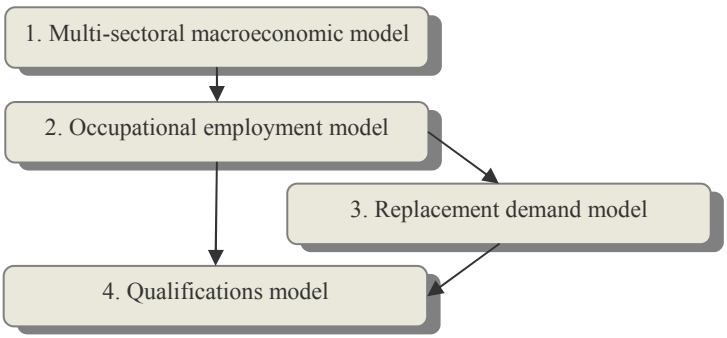
as suggested by endogenous growth theories). However, this is not regarded as a realistic prospect immediately.

Although there are advantages in getting experts involved from each country, because of their insights into data issues and country specific trends, the initial work should probably be undertaken by a single research team to take advantage of the considerable economies of scale in such work. This is not to argue that national expertise, knowledge and experience should be ignored, but to recognise that to get something started a single research team has considerable advantages in the short term. In the longer term, national experts from all countries could be involved as part of an iterative process of ongoing development. In particular, such involvement could include helping to improve the input assumptions (including data on SIC-SOC matrices) and validating results. Those involved could benefit from access to the pan-European results, which could help to inform work at national level.

Module 3 – Replacement demand model: this would be developed based on similar data sources to the occupational model. It would be driven by the occupational employment levels projected from Module 2, in combination with information on expected outflows from employment due to retirements, mortality and migration. It is likely, given existing data, that this part of the exercise would be fairly crude but it would provide a useful staring point, emphasising that it is crucial to recognise the importance of replacement demand issues and to consider them when assessing likely future skill needs.

Module 4 – Qualification model: this is perhaps the most speculative because of concerns about comparability and quality. In principle, it could be driven by the outputs from either Modules 2 or 3, but it would require additional data on occupational employment cross-classified by qualification.

*Figure 1: Modular approach to skills forecasting*




# 5. Conclusions

## 5.1. Overall approach to anticipating future skill needs

The review of best practice worldwide suggests the following:

(a) use of nationwide, quantitative, multisectoral modelling methods, to provide a comprehensive, national overview of the changing demand for skills, should be the cornerstone of the approach;

(b) more basic methods are often used for modelling occupational structure within sectors, recognising the limitations of existing data;
(c) it is important to include an explicit treatment of replacement demands, although recognising the limitations of existing data;
(d) some limited analysis of the implications for other aspects of skill such as qualifications is less frequently undertaken.

For developing a pan-European skills forecasting tool, a modular approach is, therefore, proposed involving:

Module 1: a multisectoral macroeconomic model such as E3ME;

Module 2: an occupational model based on LFS data;

Module 3: a replacement demand module (again based on LFS data);

Module 4: a qualifications module, focusing on demand implications (LFS data).

The advantages of a modular approach are that it facilitates the independent development and improvement of parts of the system. It is also a relatively low cost option.

Module 1 would be based on an existing pan-European multisectoral macroeconomic model such as E3ME. While there might be some advantages in building a new model specifically for this purpose, it is likely to be a costly exercise and the marginal benefits compared with using an existing model are likely to be modest. The important thing is to have a set of consistent sectoral projections, which are transparent in terms of the assumptions they are making about the external influences on the various countries (including technological change and the impact of global competition). A range of alternative scenarios, to demonstrate the sensitivity of the outcomes to different assumptions, can be explored.

Module 2 would be new, although it could usefully build upon the previous work in individual countries. The relevant data sources have been reviewed here. These have their limitations and inconsistencies. A key part of the work needed will be concerned with trying to reconcile these inconsistencies. While there are merits in involving individual country experts here, there are also very strong arguments, especially in the initial stages, for centralising key elements of this task and taking advantage of economies of scale.

Module 3 would again be new, but could build to some extent on previous efforts. Data on various aspects of replacement demands are in many respects even weaker than that on occupational employment structure. Nevertheless, the review of available data suggests that sufficient information exists to provide at least a broad indication of the likely scale of replacement demands, as opposed to the projections of expansion or contraction in employment levels.

Finally Module 4 would focus upon the implications for formal qualifications. As with replacement demands, the data review suggests that there are many gaps and problems with the existing data and problems of consistency across countries are probably more severe here than in any other area. Nevertheless, it is felt that these are sufficiently robust to enable the production of useful benchmark projections of trends in qualifications intensities. It is not proposed that such work would focus on the supply of qualifications at this stage.

In principle, all these modules could be undertaken independently. In practice, the data and issues involved in Modules 2, 3 and 4 are closely interrelated and are probably best undertaken, in the first instance, by a single research team. Involvement of expertise from all other countries would be highly desirable. National experts could play an important role in the first phase, especially in initial data processing and validation for Modules 2, 3 and 4, and in interpretation and dissemination of the outputs in the reporting stage.

### 5.2. Data sources and methods

The review of existing data suggests that, although there are many problems, the data are adequate to produce some benchmark projections of changing occupational structure, with implications for replacement demands and qualifications.

Having said that, there are clearly several steps that need to be taken urgently to improve the quality of:

(a) sectoral employment and related data;
(b) data on occupational employment structure within sectors;
(c) information required for estimating replacement demands.

### 5.3. Costs and resource implications

Assuming that no new primary data collection is required the costs of developing the basic models, initial benchmark projections and related reports for a pan-European set of skills projections could be relatively modest.

The main elements would be:

(a) a good set of cross European multisectoral projections from an existing model;
(b) development of a robust and consistent occupational database and related projection models;
(c) production of a good quality report, including methodological details, software and data to enable easy updating.

Costs of updating are likely to be similar to the basic setup costs. However, since there is considerable scope for further development and improvement, an annual updating cycle is probably optimal, although some countries update once every two years.

Finally, the nature of the dissemination and dialogue process conducted in conjunction with production of projections needs to be carefully thought through. Essentially, the aim should be to create a 'community of practice' bringing together forecasters and professional users of their output. The possibilities for using telematic platforms for this purpose can be deduced from the IER's UK 2004 launch of the national guidance research forum network, concerned with careers information, advice and guidance.

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# Classifications, data and models for European skill needs forecasting

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## 1. Introduction

Future skill needs in European and other countries have been observed for a long time ([8]). By forecasting the opportunities for work in Europe in a consistent and systematic way, policy-makers, educational institutions and individuals can benchmark the future skill needs in their country of interest against other countries. This is of particular importance since the methodologies and the occupational and educational classifications used by national forecasting institutions in the EU are often different from one another.

EU Member States may review their policies on developing their national education and training systems when the occupational needs are better identified. Use of information on future skill needs may also be important to meet the Lisbon and Stockholm employment rate targets. Active labour-market policies to retrain the unemployed or reintegrate individuals who are economically inactive, may take advantage of the occupational forecasts on employment growth and outflow of workers.

Labour mobility between European countries will probably increase due to fewer legal barriers and better European recognition and certification of diplomas (credentials). Therefore, information on future skill needs in Europe becomes a priority. An example of the potential relevance of international labour mobility to solve bottlenecks on national labour markets is found in a study by Marey et al. (2001). In this study future bottlenecks in the labour markets of EU Member States are identified for research scientists and engineers (RSEs) under different scenarios. The forecasting results indicated considerable shortages of RSEs in various EU Member States. At the same time, for the EU as a whole, there were excess supplies in each of the four fields of study distinguished, no matter which scenario. It was shown that there are opportunities for international labour mobility between particular EU Member States. Since this study demonstrates the advantages of skill needs forecasting when using the same data sources and equal models for many different European countries, the most important results of this study are summarised in Annex 1 at the end of this article.

We propose to analyse the future skill needs of all EU Member States by using similar models and data sources for these countries. The data should be drawn mainly from Eurostat or OECD. Using Eurostat data and European Commission forecasts has several advantages. First, employment growth and changes in employment structure are better comparable across countries when the same sectoral, occupational and educational classifications are used. For example, for the LFS of EU Member States about the same survey methods and definitions are used by the respective national statistical offices. The data provided by national statistical

([8]) See Hughes (1993), Heijke (1994), Heijke and Borghans (1998), Czech National Observatory (1999), Neugart and Schömann (2002).

offices are harmonised by Eurostat. Further, short-term employment forecasts provided by the European Commission or the OECD can be used. By using these forecasts, the occupational and educational forecasts are – as much as possible – consistent with authoritative forecasts, which provide the basis for policy decisions on important social and economic issues in the EU. Other data such as value added and capital that may be required as data input, can also be drawn from Eurostat. For some new Member States the time series are short, other countries may be too small to get reliable data at a disaggregated level.

Annex 2 presents an example of benchmarking analysis on the explanation of the occupational employment structure. We use data from the LFS – harmonised by Eurostat – of EU Member States. The disentangling of the occupational structure changes within countries into industrial, occupational and interaction effects could be a first step to make occupational forecasts for the expansion demand in these countries. To make these occupational forecasts we need both (macroeconomic) sector forecasts and forecasts of changes in the occupational structure within sectors.

In this paper we discuss the goals of European skill needs forecasting (Section 2) and the relevance of benchmarking across countries and time (Section 3), summarise the basic forecasting model (Section 4), and discuss the role of Cedefop in a network of forecasting institutions (Section 5).

# 2. Goals of European skill needs forecasting

As is argued in, for example, Cörvers et al. (2002), the planning concept has been abandoned in modern labour-market forecasting. Instead, agents on the labour market – for example graduates, employed and unemployed individuals, schools and firms – are continuously trying to improve the match between the skills acquired at school and the skills required on the labour market. Education and training are often not exclusively related to particular jobs. Depending on their educational and training background, individuals can be employed in a broad range of occupations. However, vocational education may generate skills that are only productive within a small occupational domain, suggesting a trade-off between productivity and flexibility of educational courses. Education in health care and teaching strongly raises productivity in the corresponding occupational domains. Schools may want their graduates to have a good starting position on the labour market, in particular within their occupational domain. But in case of a loose labour market within the corresponding occupational domain graduates should be able to work outside their occupational domains. However, outside their occupational domains, they may have a comparative disadvantage relative to graduates with degrees in administration, business or economics. On the demand side of the labour market employers may substitute workers with different educational backgrounds. Substitution possibilities depend on the specificity of skill requirements within firms or organisations, and may change over time due to technological and organisational developments or changes in educational courses.

Instead of a policy of direct intervention to ensure correspondence of the education system to the labour market, providing adequate information would make the labour market more transparent to those choosing a course of study and others investing in education. Transparency would enable the supply of labour to be more responsive to changes on the labour market. It would then automatically conform better to new employment opportunities. Moreover, labour-market

forecasts give employers an indication of the future risk of labour recruitment problems for various skill categories. This enables them to anticipate future shortages and remedy them, for example through internal training and outflow reduction policies for categories of workers for which future shortages are forecast. It follows that increasing transparency for individuals and organisations on the labour market should be the goal of manpower forecasting in EU countries.

Setting this goal of European skill needs forecasting implies that user groups can be identified. Labour-market information is relevant for those choosing a course of study and others investing in education, for employers taking strategic decisions on recruitment and replacement, and for schools offering educational programmes that are both attractive to students and generate the required competences for the labour market. This raises the question to what extent information provided at European level is superior to national labour-market information already available in many countries. The answer is a European labour information system should provide information that is complementary rather than superior to national information. Information provided at European level should in particular be useful for all individuals and organisations interested in looking across national borders (Council of the EU, 2005).

Specifically, European skill needs forecasting could be directed at providing information on:

(a) international opportunities for work after graduation. This enables graduates with a particular educational background to work in any EU Member State;
(b) the competitive position of a particular national educational programme on the European labour market;
(c) international opportunities to work in specialised jobs in EU Member States. This is for those who already have specific labour-market experience in their home country. This could help international labour-market mobility and increase migration flows of workers;
(d) the underutilised human capital potential in EU Member States. This may be useful for firms that want to recruit personnel from abroad or are rethinking the location of their business activities.

# 3. Benchmarking across countries and time

To ensure greater transparency of employment and training opportunities, it should be possible to benchmark labour-market forecast information from different European countries. Benchmarking may have two dimensions: benchmarking across countries and across time.

## 3.1. Benchmarking across countries

Benchmarking across countries requires harmonising labour-market information one use of definitions, classifications and models of labour demand and supply. To preserve consistency between aggregated labour-market information (e.g. employment growth of sectors) and detailed information (e.g. employment growth of particular occupational groups), it is important to use both a fitting general forecasting model and national databases which distinguish between the various occupational groups and fields of education. In a top-down approach to labour-market forecasting we can adequately deal with interactions between different labour-market segments and substitution processes between occupational groups ([9]).

([9]) See the top-down approach to labour market forecasting in the Netherlands as discussed by Cörvers (2003).

A top-down approach – from a European perspective – can also better take account of mobility flows between countries.

Top-down forecasts and scenarios should exploit international comparable databases. These data sources should cover all segments of the labour market, be consistent with data on other important national economic developments, for example GDP (gross domestic product) growth, employment growth, demographic trends, and be consistently differentiated to lower levels of aggregation. These data sources should be available EU-wide on a regular and coherent basis. If available databases do not fulfil all necessary conditions for international comparative analyses the network should see these conditions are met. Forecasts and scenarios should be based on international consistent forecasts of economic, social, and demographic variables at macro level.

A top-down approach implies that one should not concentrate solely on occupations related to vocational education and training. The strength of such modelling is that the developments on the whole range of occupations on the labour market are considered, including intermediate occupations. A model of the labour market that just focuses on the intermediate occupations cannot account for shifts in the occupational structure within sectors of industry. For example, if professional occupations mainly benefit from a strong increase in employment growth at macroeconomic level, the employment growth of intermediate occupations may be overestimated if we shifts in occupational shares within sectors are not considered.

# 4. Benchmarking across time

Forecasting skill needs often refers to anticipating changes in employment levels, or changes in the labour-market position for particular fields of education. This implies that information should be provided on both actual and future labour-market opportunities. For example, although it may be attractive for graduates in economics to migrate to country A with high wages and low unemployment and overschooling (underutilisation) in economics relative to country B, a bad labour perspective in economics for country A may change their decision since wages may go down and unemployment and (overschooling) underutilisation rise over time. Graduates could consider this information when looking at the costs, benefits and risks of migration to a particular country.

Information on the expected future labour-market situation may concern the following variables (see Section 4 for further explanation):

(a) expansion demand by sector, occupation and education,
(b) replacement demand by occupation and education,
(c) number of job openings,
(d) supply by education,
(e) indicator of the future labour-market situation for graduates,
(f) indicator of the future recruitment problems for employers.

The information provided may be limited to a qualitative description of labour-market prospects of training categories or recruitment problems of particular occupations, on a scale from ‘good’ to ‘poor’. Use of qualitative descriptions would prevent quantitative forecasts being treated as more precise than they are.

To benchmark expectations on the future labour-market situation, information should be provided on the current labour-market situation for all sectors, occupations and educational fields distinguished in the forecasting model. The information may concern the following variables:

(a) unemployment and participation per educational level and field,
(b) wage level by occupation and education,
(c) working below level (underutilisation or overschooling) or outside occupational domain,
(d) distribution of occupational employment per educational category,
(e) educational employment structure within occupations,
(f) working part-time (involuntary) or in short-term contracts,
(g) other conditions of employment,
(h) volatility of employment by occupation and education,
(i) vacancy rates by occupation and education,
(j) migration flows by education.

A bad indication for the future labour-market situation for a particular type of education may not only lead to an increase in unemployment or a lower wage level, but also to more underutilisation or working outside an occupational domain, worsening conditions of employment, and decreasing immigrants with the educational background in question, etc. (see also Wieling and Borghans, 2001).

Forecasts could be limited to the medium term, a period of five years. Within this horizon changes on the labour market are less uncertain than in the long term, in particular the outflow of graduates from the educational system to the labour market. Moreover, uncertain results of substitution, geographical mobility and other adjustment processes can be decisive, in particular when discrepancies between demand and supply are extremely large. A forecast period of five years is sufficiently long to produce useful labour-market information for those investing in a course which will last for several years. However short-term forecasts for the coming year or two-year period may be important for recruiting personnel, for short-term training courses and other short-term labour-market programmes and for preparing the unemployed or non-active to enter the workforce.

Forecasts do not have to be repeated every year. This makes it possible to keep a finger on the pulse, while leaving sufficient time to evaluate observed differences between forecasts and the achieved results on the market and to use these evaluations to improve the forecasting method. Differences between forecasts and results tend to increase over time. Waiting longer than two or three years to make modifications will not only encourage bad decisions on training and education, but visible mistakes in forecasting will also contribute to a negative image of labour-market forecasts.

# 5. Forecasting labour demand and supply

On the demand side of the labour market a distinction should be made between demand resulting from future changes in employment levels – expansion demand – and demand due to retirement and occupational mobility – replacement demand. The model can be based on the methodologies used by, for example, IER for the UK, ESRI for Ireland and ROA for the

Netherlands (see Heijke, 1994; Heijke and Borghans, 1998; Neugart and Schömann, 2002). These methodologies have already been adopted by some other countries.

Forecasts of expansion demand can be based on short-term employment level forecasts from the European Commission. It is necessary to differentiate these forecasts of employment growth by sectors of industry, and to lengthen the forecasting period. Employment trends from the past can be used to extrapolate sectoral employment growth in different scenarios (e.g. high versus low growth). In place of fixed coefficients for the occupational and training structure of employment, explanatory models are used to describe the changes in both structures over time. Additional explanatory variables such as value added, labour productivity and investments in R&D and capital could be used. Likewise, expansion demand per educational category should be forecast, accounting for changes in educational structures within occupations, including increasing skills requirements (upgrading).

Labour-market demand consists not only of expansion but also of replacement demand, which arises when workers retire, leave the labour force under an early retirement scheme or because of a disability, withdraw from the labour-market temporarily, or switch to another occupation, complete an educational course at a higher level or in another direction, etc. Because there is no appropriate data for mobility flows on the labour market, stock data can be used. By means of the so-called cohort components method cohort-change rates can be used. These are based on the number of persons of the same birth cohort employed at two different times. The resulting inflow and outflow can be translated into replacement demand by occupational group or type of education. Another important step is to project the historically measured net replacement demand rates per age-sex group for a particular occupational group or type of education onto the age-sex structure of the workers at the beginning of the forecasting period (see for further details e.g. Cörvers et al., 2002).

Replacement demand only arises if departure of an employee leads to a vacancy for a new entrant. If departure of a worker is taken as an opportunity to cut employment levels, no replacement demand results. These flows out of the labour market are irrelevant for newcomers. If employment levels rise, expansion demand and replacement demand together compose the job openings for newcomers to the labour market. If they fall, job openings can only arise because of replacement demand.

To be able to show future labour-market prospects for newcomers to the labour market, we have to compare job openings for newcomers with the expected supply of newcomers. The latter consists of the future flow of school-leavers entering the labour market and the outflow from post-initial training courses during the forecast period, plus the supply of short-term unemployed persons waiting to enter the market at the start of this period. It is assumed the long-term unemployed, who have been looking for work for longer than a year, no longer constitute serious competition for school-leavers.

An indication of future labour-market prospects for newcomers to the labour market is calculated, for each type of education, by comparing the expected flows of demand and supply with each other. This indicator shows any expected discrepancy between demand and supply for each type of education. Excess supply does not necessarily imply the group in question will automatically become unemployed, or a supply shortfall automatically leads to unfilled vacancies. In practice, school-leavers with a type of education for which supply exceeds demand suffer from a worsening position. They are more likely to have to accept work below their level, get less favourable contracts, be paid less and more likely to work part-time involuntarily (Wieling and Borghans, 2001). In such situations, employers normally adjust their demands

and recruit people with a higher educational background. However, if there is a supply shortage, school-leavers will not have to accept a job at a lower level, for lower wages, etc.

Because of substitution processes, there are fewer job openings for those suffering from 'crowding-out' with types of education in excess supply. However, for those with educational backgrounds closely related to types of education in short supply, there will be extra job openings. These passive substitution effects are thus important determinants of labour-market prospects for types of education.

For European skill needs forecasting it is important to cast light on the possible adjustment and substitution processes between countries. These processes may take place on both the supply and the demand side of the labour market. On the supply side of the labour market, workers or graduates may choose to migrate to another country when the labour-market situation in their country is bad. Young people may also choose to continue their studies in another country. Although the flows of workers, graduates or students may only be marginal as a percentage of the total labour force, for some occupations (e.g. drivers or construction workers) these numbers may be substantial. On the demand side of the labour market, firms may decide to relocate their businesses to other countries because of the availability of more or better skilled workers, at lower wage costs. Information on the actual and future opportunities to move between countries may improve the matching of labour-market needs (Council of the EU, 2005).

# 6. Role of Cedefop

There must be a balanced role for both Cedefop and researchers in the forecast activities of the network. Cedefop can play an important role in initiating and supporting network activities and disseminating the outcomes to the public. It can bring all parties involved together and organise meetings. Cedefop can also play a role in finding financial support for network activities. Network participants must be given enough autonomy to participate fully in their own networks, choosing the criteria for selecting participants, develop plans for research activities and disseminate outcomes, draw up strategies to realise these plans and set priorities. A committee of two or three leading participants and a member of Cedefop could be set up to drive things forward.

It is important to have a clear picture of the role of the different parties interested in network activities and to organise the network accordingly. The network should primarily consist of highly qualified independent researchers. Other parties should only participate when specific contributions are needed - preferably researchers who already take part in similar analyses in other frameworks. Every participating researcher has to play an active role and free riders have to be excluded. Representatives of governments, VET systems and associations of employees or employers should only take part in network activities when their responses to plans and study results or dissemination of results are on the agenda. Separating meetings where researchers freely speak about their plans and work from meetings where policy-oriented people can comment on plans, study results and disseminating results will make the network more effective and stimulating.

# Annex 1: The labour market for research scientists and engineers (RSEs) in Europe – example

In a knowledge-driven global economy, it is essential that the education system produces sufficient science and technology (S&T) graduates both in quantitative and qualitative terms. The hard core of personnel in R&D departments are RSEs. In many European countries there is serious concern about a future shortfall in supply, compared to demand, for RSEs, i.e. researchers in the exact sciences: mathematics and natural sciences, technical sciences, agricultural science and medical science. Among the causes of the possible shortage of RSEs, demographic developments such as the ageing working population should be mentioned first. Rapid development in various technological fields, as a result of which researchers' knowledge becomes obsolete, also plays an important role in the demand for freshmen. Finally, many European countries face declining interest of youngsters in science and engineering studies.

Forecasts for the various Member States indicate that several Member States will face shortages of RSEs in one or more fields of study. These forecasts should (at the time of producing them), however, be interpreted as *ex ante* forecasts. In practice, labour markets have adjustment processes which will bring the difference between labour demand and supply down. This does not mean that there will be no *ex post* shortages. It also does not mean that *ex ante* shortages matter less: adjustment processes often require high costs. Adjustment processes may take place within the labour market for RSEs in a specific field of study, between labour markets for RSEs with different fields of study and between labour markets for RSEs in different countries.

**Adjustment processes**

An important adjustment process on the demand side of the labour market for RSEs with a specific field of study is the time spent by RSEs on non-R&D tasks. Workers with other qualifications (lower level of education or other field of study) can be recruited to perform the non-R&D tasks. When the *ex ante* shortage of RSEs is not too large, this adjustment process may reduce the number of job openings in the *ex post* situation to match the low level of RSE inflow. A closely related adjustment process is an increase in total working hours, by stimulating overtime of qualified RSEs. Other adjustment strategies that employers may follow to reduce shortages include improved management, substituting physical capital for human capital and even reducing R&D activities (see Borghans et al., 1998; Wieling and Borghans, 2001).

Adjustment processes may also take place on the supply side of the labour market for RSEs with a specific field of study. When the ratio of RSE inflow to total flow of S&T graduates is relatively small, there may be a hidden potential of S&T graduates who do not yet apply for RSE jobs *ex ante*, but who may decide to do so *ex post*. Motives may be good employment opportunities for RSEs or changing job preferences induced by for example promotional campaigns. Of course, higher wages may also be used to attract more RSEs. However, one might wonder if the productivity of these workers in RSE jobs is at the same level as the productivity of S&T graduates with a higher preference for RSE jobs. An additional pool of S&T graduates from which new RSEs may be recruited are the unemployed. Since supply forecasts refer to the total flow of S&T graduates from 1997 to 2002, the relevant figure is the number of unemployed S&T graduates in 1997. However, according to the labour queue theory (Thurow, 1975), a longer duration of unemployment, on average implies lower quality of the unemployed S&T graduate. In addition, there may be a loss of skills. Hence both supply side adjustments may be accompanied by a loss in quality and productivity.

An additional adjustment process may take place between labour markets for RSEs with different fields of study. An important opportunity is the similarity between certain natural science curricula and technology and engineering curricula. For example, a shortage of chemistry RSEs (natural scientists) may be alleviated by an excess of chemical engineering RSEs (technology and engineering). From the demand side this would probably entail reorganisation of R&D tasks of natural scientists and on the supply side it implies that graduates are willing to work outside their field of study.

Another possible adjustment process is international labour mobility. A shortage of natural scientists in one Member State may be reduced by an excess of natural scientists from another. Of course, this requires a fully integrated European labour market with a geographically mobile labour force. However, in practice there are often various barriers to mobility such as mutual recognition of educational qualifications, geographical distance, differences in language and culture and fiscal differences. On the other hand, in-company mobility may promote international mobility. Incentives for international migration are differences in wages and benefits. After full introduction of the euro the lack of transparency of the real wage differentials will decrease, which will probably further ease international mobility.

In many instances, international labour mobility may be a considerably less costly adjustment mechanism than intra-national adjustment mechanisms. According to human capital theory (Becker, 1962), it is an adjustment mechanism especially suited for young S&T graduates. Young people have a longer period to write off the costs of moving to another country, while S&T graduates have a large knowledge potential which can generate a high income path (Hansen et al., 1992). Also, international mobility within a multinational firm often relates to higher educated staff.

It is however important to recognise there are costs both for the demand side and the supply side of the labour market associated with all these adjustment processes. If an ex ante shortage does not materialise as an (equally large) ex post shortage due to the adjustment processes described above, this does not mean that manpower problems are overestimated by the *ex ante* shortage. The reduction from the *ex ante* shortage to the *ex post* shortage has come at a cost, which in some cases can be considerable. So the *ex ante* shortage provides a general indication of the problems associated with a lack of balance between labour demand and supply.

To assess possible future shortages of RSEs in various EU Member States, we developed a model to track the relevant flows of RSEs on the labour markets. The estimated models are from national models used by ROA, but the concepts of expansion and replacement demand, and the inflow of graduates on the labour market are the same as described in Section 4. Under this approach forecasts are made of the flows entering and leaving the labour market in the period from 1997 to 2002. This approach enables us to make a confrontation between labour demand (the expected job openings for RSEs) and labour supply (expected inflow of new RSEs).

**Results**

Table 1 summarises the results of the study by Marey et al. (2001). The table provides an overview of expected RSE shortages in various Member States at the end of the forecasting period in 2002 (second column), the effectiveness of intra-national adjustment processes (third column) and the suggested international RSE flows which could solve the most serious shortages (fourth column).

*Table 1: Overview of expected RSE shortages in 2002 and effectiveness of adjustment processes*

| Country | Projected RSE shortages (1997-2002) | Effectiveness of domestic adjustment processes | Possible sources of RSE inflow from other Member States |
|---|---|---|---|
| Belgium | None | | |
| Denmark | Natural sciences | limited | Greece, Spain, Italy |
| Germany | Natural sciences<br>medical sciences | limited<br>sufficient | Greece, Spain, Italy |
| Greece | None | | |
| Spain | None | | |
| France | Natural sciences | sufficient | |
| Ireland | Medical sciences | limited | United Kingdom |
| Italy | Medical sciences | sufficient | |
| Netherlands | Natural sciences<br>medical sciences | limited<br>limited | Greece, Spain, Italy, France |
| Austria | Natural sciences<br>medical sciences | sufficient<br>limited | France |
| Portugal | Natural sciences | sufficient | |
| Finland | None | | |
| Sweden | Natural sciences<br>technology and engineering<br>medical sciences<br>agricultural sciences | Sufficient<br>sufficient<br>sufficient<br>sufficient | |
| United Kingdom | None | | |

It follows that not all countries may be able to deal with RSE manpower problems themselves, specifically Denmark, Germany, Ireland, the Netherlands and Austria. This means there are opportunities for international labour mobility, since no shortages were expected for the EU as a whole. The forecasts, therefore, emphasise the importance of European labour-market integration. The shortages of medical science RSEs in Ireland are relatively small compared with the excess supply of medical science RSEs in the UK in all scenarios, except the high GDP growth – high human capital growth – scenario. Given the short distance, cultural similarity and absence of language problems between Ireland and the UK, the mobility of medical science RSEs from the latter country to the former would solve the shortages in Ireland. The shortages of medical science RSEs in Austria and the Netherlands can also be solved by mobility from countries with excess supplies, especially France. The shortage of natural science RSEs in Germany are considerable, but countries like Greece, Spain and Italy have considerable excess supplies of graduates with the required educational backgrounds which could fill the job openings. These countries could also contribute to solving the shortages for natural science RSEs in Denmark and the Netherlands.

Of course, international labour mobility is not only important where certain Member States are unable to solve their own RSE manpower problems. It may also be a cheaper alternative to costly intra-national adjustment processes in a Member State facing shortages of RSEs. For example, while Sweden is expected to face mild shortages in all fields of study distinguished, Finland has excess supplies in all fields. Since Sweden and Finland are neighbouring countries and many Finnish people have a good grasp of the Swedish language, the mobility of Finnish RSEs to Sweden would be an answer to the shortages in Sweden, without the costs associated with intra-national adjustment processes.

# Annex 2: Shift-share analyses for countries in the EU – example

This annex presents the results of a shift-share analysis of the occupational structure of two countries, Estonia and the Netherlands, relative to the average of 25 EU countries. The analysis could be a first step to making occupational forecasts for expansion demand in these countries. The analyses based on the LFS of EU countries could also answer the following questions.

(a) Are the dynamic changes in countries' occupational structure different across new and old Member States?

(b) Are new Member States converging towards the structure of old Member States?

(c) What is the most important effect of counting the dynamic changes in occupational structure? Is this result sensitive to the group of countries in terms of old and new Members States?

Changes in a country's occupational structure over time can be attributed to three effects: the industrial effect ( $I_i^k$ ), the occupational effect ( $II_i^k$ ) and the interaction effect ( $III_i^k$ ).

$$dd_i^k = o_i^k - \overline{o}_i = I_i^k + II_i^k + III_i^k$$

Where the changes in every occupation $i$ is noted as $dd_i^k$; $o_i^k$ denotes the country's $I^{th}$ occupational share in country $k$ and $\overline{o}_i$ the EU cross-country average occupational share. $\overline{o}_i$ has been calculated as follows:

$$\overline{o}_i = \frac{\sum_{k=1}^{n} o_i^k}{n}, k = 1, \ldots, n$$

The number of countries, $k$, in the analysis is 25, $k = 1, \ldots, 25$. Occupational shares are at one-dimensional ISCO classification level, $i = 1, \ldots, 11$, one additional classification group was added to account for the share of the unknown occupation group. Industry shares are at one-dimensional NACE classification level, $i = 1, \ldots, 18$, where one sector includes an unknown economic activity.

The occupational shares across countries and for the EU average sum up to one:

$\sum_i o_i^k = 1$, for every country $k$ and $\sum_i \overline{o}_i = 1$

The occupational shares for every industry and employment shares for every country sum up to one:

$\sum_i o_{ij}^k = 1$, for every industry $j$ and country $k$; $\sum_i \overline{o}_{ij} = 1$ for every industry $j$

$\sum_j s_j^k = 1$, for every country $k$ and $\sum_j \overline{s}_j = 1$

The industrial effect ( $I_i^k$ ) reflects the country's occupational structure due to the employment allocation between production sectors. If the country's occupational structure for every economic activity were equal to the EU average, then differences in country's and EU overall occupational structure would be wholly accounted for by the differences between the country and the EU with respect to the employment allocation between production sectors. Or in other

words, if the technology for a production sector were the same for every country in the EU, the occupational structure of the individual country could still differ because of the different importance of each production sector.

$$I_i^k = \sum_j \bar{o}_{ij} * \left(s_j^k - \bar{s}_j\right)$$

Where $\bar{o}_{ij}$ notes the EU average $I^{th}$ occupational share in industry *j*; $s_j^k$ the country *k* industry *j* employment share and $\bar{s}_j$ the EU average industry *j* employment share.

The occupational effect ($II_i^k$) gives rise to differences in the occupational structure within similar production sectors across countries. If the country's industry structure in terms of employment were the same as the EU average, its overall occupation structure could differ because of the different occupational structure across similar production sectors. Thus this component may reflect the differences in occupational structure due to different technologies used in the same production sector.

$$II_i^k = \sum_j \left(o_{ij}^k - \bar{o}_{ij}\right) * \bar{s}_j$$

Where $o_{ij}^k$ notes the country *k*'s $I^{th}$ occupational share in industry *j*, $\bar{o}_{ij}$ the EU average $I^{th}$ occupational share in industry j and $\bar{s}_j$ the EU average employment share in industry *j*.

The interaction effect ($III_i^k$) arises due to interaction between occupation *i* shares across industries and employment shares across industries, that calculated for every occupation *i* and every country *k*. Interaction effect is positive if compared to EU average country's occupation *i* is more important for sectors that country is specialised in. The opposite holds if *I* 's occupation is unimportant for sectors that country is specialised in.

$$III_i^k = \sum_j \left(o_{ij}^k - \bar{o}_{ij}\right) * \left(s_j^k - \bar{s}_j\right)$$

Where again $o_{ij}^k$ notes the country *k*'s $I^{th}$ occupational share in industry *j*; $\bar{o}_{ij}$ the EU average $I^{th}$ occupational share in industry *j*; $s_j^k$ the country *k* employment share in industry *j* and the EU average employment share in industry *j*.

**Estonia**

Results of the static analysis for Estonia are shown in Table 2. Compared to EU average Estonia has much more workers occupied in lower skills occupational groups; the only exception is the first occupational group of legislators, senior officials and managers. The industry mix component accounts for the differences in occupational structure due to differences in allocation of employment across industries. If the production technology in Estonia were the same as the EU average, Estonia would still have more workers employed in lower occupational levels. Thus, the Estonian industry structure uses lower level occupational labour, in sectors such as fishery; mining; manufacturing; electricity, gas and water supply which, compared to EU-25 average, are more important in the Estonian economy. The occupational structure differential component accounts for the differences in occupational structure due to differences in technology across production sectors. If Estonia had the same employment structure of economic activities then due to different technologies in production sectors it would still have more workers occupied in lower level occupational groups. Thus in sum, both the industry structure and production technology in Estonia are inclined towards lower skilled labour.

*Table 2: Estonian occupational structure compared to EU-25 average, 2004*

| Occupational group | total effect | industrial | occupational | interaction |
|---|---|---|---|---|
| Legislators, senior officials and managers | 0.04551331 | -0.002240 | 0.045001 | 0.002755 |
| Professionals | -0.02325733 | -0.003660 | -0.018990 | -0.000610 |
| Technicians and associate professionals | -0.01804349 | -0.007120 | -0.005770 | -0.005150 |
| Clerks | -0.05952775 | 0.000101 | -0.060280 | 0.000656 |
| Service workers and shop and market sales workers | -0.00434834 | -0.017890 | 0.017060 | -0.003520 |
| Skilled agricultural and fishery workers | -0.02215647 | -0.005380 | -0.019410 | 0.002634 |
| Craft and related trades workers | 0.00531644 | 0.016762 | -0.009910 | -0.001540 |
| Plant and machine operators and assemblers | 0.05434135 | 0.023846 | 0.024610 | 0.005885 |
| Elementary occupations | 0.02557069 | -0.003500 | 0.025137 | 0.003932 |
| Armed forces | -0.00105355 | -0.000110 | -0.001040 | 0.000100 |
| Occupational group unknown | -0.00235484 | -0.000800 | -0.002350 | 0.000805 |

*Source*: LFS, own calculation.

## The Netherlands

Results of the static analysis for the Netherlands are shown in Table 3. The differences in occupational structure compared to EU-25 average are quite the opposite of the Estonian example – there are more workers employed in higher occupational groups and fewer workers in lower occupational groups. The industry mix component indicates that if the technology were equal to EU-25 average the differences in industry structure would still make more workers work in higher occupational groups. This shows the industry structure in the Netherlands is more inclined to industries that use more high-skilled workers. The occupational structure differential component shows that if the Dutch industry structure were the same as EU-25 average it would still use more high-skilled workers as its production technology originates more from high-skilled labour input. Thus, in contrast to the Estonian example, the Dutch economy relies more on workers from higher occupational groups, both in terms of industry structure and production technology.

*Table 3: The Netherlands' occupational structure compared to EU-25 average, 2004*

| Occupational group | total effect | industrial | occupational | interaction |
|---|---|---|---|---|
| Legislators, senior officials and managers | 0.017899 | 0.002306 | 0.030248 | -0.014660 |
| Professionals | 0.049034 | 0.016777 | 0.031783 | 0.000474 |
| Technicians and associate professionals | 0.033722 | 0.020121 | 0.005731 | 0.007869 |
| Clerks | 0.019359 | 0.005155 | 0.017535 | -0.003330 |
| Service workers and shop and market sales workers | -0.000950 | 0.012529 | -0.012250 | -0.001240 |
| Skilled agricultural and fishery workers | -0.027970 | -0.019970 | -0.017930 | 0.009931 |
| Craft and related trades workers | -0.053090 | -0.030050 | -0.031580 | 0.008543 |
| Plant and machine operators and assemblers | -0.033410 | -0.017050 | -0.019530 | 0.003170 |
| Elementary occupations | -0.010130 | -0.003340 | -0.009720 | 0.002934 |
| Armed forces | -0.001550 | 0.001094 | -0.001410 | -0.001240 |
| Occupational group unknown | 0.007086 | 0.012429 | 0.007120 | -0.012460 |

Source: LFS, own calculation.

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# Part II

# Information input from Member States using Cedefop's template

# Austria

*Peter Steiner; Lorenz Lassnigg; Institute for Advanced Studies (IHS)*

**Question 1: How are skills defined in skill needs forecasting approaches in your country?**

In Austria, skills are mainly defined via educational attainment (mostly country specific definitions) or occupational activities (based on variations of ISCO or formerly the more specified occupational classification used by the public employment service), some forecasts have also used sector classifications of economic activity. There is no commonly agreed classification so different studies have used different classifications, which are hardly comparable.

A specific method used by our institute (IHS) for classifying skills combines occupational classifications with the highest level of educational attainment. For this purpose occupational skills are cross-classified with educational attainment, where both classifications are generally based on country-specific classifications although compatibility with international standard classifications is sought. However, ISCED levels do not specify important distinctions in the formal structure of qualification levels in Austria (for example, between apprenticeship qualifications and the two levels of VET-schools and colleges). Use of this classification (occupations *x* educational attainment) is primarily due to intended comparisons of skill demand and supply, hence, a simultaneous classification of occupations and formal qualification is inevitable.

**Question 2: Which main method is currently used for mid/long-term forecasting of skill needs at macroeconomic level in your country?**

There are three main forecasting approaches, developed by three different institutions:

(a) forecast of skill needs and supply by the IHS;

(b) forecast of skill needs by the Austrian Institute of Economic Research (WIFO);

(c) micro simulation by Synthesis Forschung (SYNT), which is a more sectoral and regional-oriented approach rather than skill needs-oriented in the above sense.

The following questions are addressed for each method separately.

**[IHS] The mid-term forecast of skill needs mainly consists of four steps (Lassnigg et al., 1997)**

*Sectoral employment forecast*
The employment forecast by sector stems from a mid-term macroeconomic sectoral forecast model (WIFO). One specific output of this model is a forecast of overall employment and employment by sector (based on employment data from the Austrian social security agency).

*Shift-share analysis*
In a second step yearly employment growth rates of each occupation are broken down into an overall effect, a sectoral share effect and an occupational share effect (Meagher, 1995). In other words, employment growth of a given occupation is the sum of the overall employment growth rate, the growth due to the dynamics of the sectors of main importance to the occupation, and

the growth rate due to the dynamic of the occupation itself. For this step, an additional data source, the Austrian quarterly population survey (Mikrozensus), which also includes the LFS by Statistics Austria, is necessary because sectoral employment data from the social security agency do not contain occupational information. For each quarter data are organised in a sectors *x* occupations-matrix. The same shift-share analysis can also be undertaken for the quarterly occupations *x* educational levels-matrix, such that employment growth can be broken down into the overall growth rate, an occupational and educational share effect.

*Forecast of employment by occupations*
While forecasting overall growth and the industry share effect is directly obtained from the sectoral employment forecast in combination with the relative sectoral distribution within each occupation (sectoral distribution matrix), the occupational share effect has to be predicted from past occupational share effects. This projection is done by simple time series methods, namely trend projections with Holt-Winters procedures. Consequently, projecting the employment growth of each occupation is given by the sum of the projected overall growth and the two share effects.

*Projection of employment by educational attainment*
A further optional step considers the dynamic of educational attainment within each occupation. For this purpose the relative distribution of educational attainment within each occupation are projected by simple time series methods.

**[WIFO] The method has been developed for forecasting regional skill needs and consists of three main components (Huemer et al., 2002)**

*Austrian sectoral macro model*
This first step is based on the same macroeconomic model as the IHS model described above. However, the WIFO model uses in addition to sectoral employment forecasts, sectoral forecasts of output and value added as input to the regional sectoral model.

*Regional sectoral model*
Forecasting regional sectoral employment is part of the regional sectoral model output, which is based on regional input-output tables.

*Projection model for occupations*
In this step employment forecasts of the regional sectoral model have to be structured from occupational information. For this reason, data from the quarterly national survey are used to obtain employment matrices by sectors *x* occupations. These matrices are used to generate and forecast the relative distribution of occupational employment for each sector (occupational distribution matrix). Hence, these distributions are used to impose the occupational structure onto sectoral employment. Projections of the occupational distribution matrix elements are obtained by a weighted GLS-procedure (residuals of the first estimate are used as GLS-weights). In addition, some restrictions are imposed on occupational projections (such as fixed relations to the overall Austrian occupational forecast, restrictions on teacher demand based on projections of pupils and classes). In sum, this leads to inconsistent

estimates so adjustment procedures are necessary. As in the IHS-model, employment growth can be broken down into a sectoral and an occupational effect.

### [SYNT] Synthesis Forschung uses a different approach for projecting skill needs (Altenender et al., 2001)

The whole model consists of two submodels, the macro and the micro. Therefore, this approach integrates a macroeconomic model with a microeconomic simulation model, which models the recruitment behaviour of companies. Employment output is primarily broken down by sector, region, gender, and educational attainment. Hence, due to data restrictions, skill needs are not defined by occupation but only by a rough national educational attainment classification.

*The macro model*

In a first step Synthesis Forschung gathers and assesses overall GDP forecasts and sectoral output forecasts from different international institutions (e.g. OECD, European Central Bank, IFO Munich, Economist Intelligence Unit). Then one of the GDP forecasts is chosen for projecting GDP per employee and consequently overall employment. Similarly one of the output forecasts serves as a basis for output-elasticity projections of sectoral employment, which are in turn used for the sectoral employment projection. Finally, the overall and sectoral employment projections are balanced for possible differences.

*The micro model*

The micro model is mainly based on individual data from the Austrian social security agency where the primary units of observation are companies. First, a historical reference period is selected as empirical basis for the projection period. Within the reference period the companies are classified into three groups: continued, newly founded and shut-down companies. For this, Poisson-parameters (expectation) are estimated. Then, for each company group individual employment data are used to estimate the probabilities of continued, newly created and released jobs, conditioned by several characteristics of companies (region, sector, size) and employees (gender, age, education, occupation, activities, region, working hours, wage, employment duration). These conditional probabilities, which are allowed to change according to historical trends, are then used for simulating employment development within companies during the projection period. The dynamics of companies (continued, founded, shut-down) are modelled by Poisson processes. Interdependencies between companies and their employment (e.g. newly created jobs must be reflected by some released jobs) are considered by a set of restrictions, which in effect results in adjustments to conditional probabilities.

*Combining the macro and micro models*

Since the macro and micro models do not necessarily result in identical projections of overall or sectoral employment, the two models have to be adequately balanced. Both model-parts show some flexibility. Hence, both models can be modified through parameter adjustments until correspondence of the two models is reached.

**Question 3:** **Which methods/models are used for the input information on macroeconomic forecasting and (sectoral) employment projections?**

[IHS] The mid-term forecasts of total and macroeconomic sectoral employment of WIFO are used. The model (Multimac IV) is input-output-based at a medium aggregation level of 36 sectors, and combines econometric functions for goods and factor demand, prices, wages and the labour market with the input-output accounting framework (Kratena and Zakarias, 2001).

[WIFO] The model employs the same macroeconomic sectoral model as the IHS-model described above. But in addition, a regional sectoral model, which is linked to the macroeconomic model, is used for projecting regional sectoral employment figures.

[SYNT] The macroeconomic forecasts of GDP and sectoral output are used for deriving overall and sectoral employment (via GDP per employee and sectoral output-elasticity). For this purpose the GDP and output forecasts are selected from a pool of forecasts (e.g. OECD, European Central Bank, IFO Munich, Economist Intelligence Unit).

**Question 4:** **Does the skill needs forecasting method only include forecasts of total demand or also expansion demand and replacement demand?**

[IHS] At the moment, the model addresses expansion and replacement demand of skills separately. However, both components of demand are not separately published. Replacement demand is estimated by a rough procedure, which uses average retirement rates. Combining expansion and replacement demand is necessary for comparison with the supply side of skills.

[WIFO] The focus is primarily on expansion demand. But for future comparison requirements with the supply side replacement demand will be considered.

[SYNT] The logic of the micro model suggests that expansion and replacement demand are separately addressed, since continued, newly created and released jobs are modelled with different conditional probabilities.

**Question 5:** **Does the method consider the supply side, and possibly interaction between supply and demand?**

[IHS] The supply side of skills is also forecast. Forecasts of the demand and supply sides are independent and are only used for a rough comparison of supply and demand. Consequently, in forecasting, skill needs restrictions due to the supply side are not considered. Such restrictions are the result of the skill demand-supply comparison and not input to skill needs projections.

[WIFO] The core model considers only the demand side, but supply side information is currently included in cooperation with the IHS.

[SYNT] The supply side is not considered.

**Question 6:** **Does the approach also consider (exogenous) factors such as impact of technologies, work organisation, socioeconomic conditions, globalisation/relocation of jobs, etc.?**

[IHS] Such factors are included in the skill needs forecast model to some extent via the WIFO macroeconomic sectoral model. The main factors included are standard economic variables (e.g. prices, wages, income, factor and goods demand). Influential factors on the occupational and/or educational structure of employment cannot be addressed.

[WIFO] Exogenous factors are to some extent included in the macroeconomic and regional sectoral models (see the IHS-model above). Concerning influential factors on the occupational

structure, some minor restrictions are imposed in the WIFO forecast, for example, employment of teachers depends on the expected development of pupils and classes.

[SYNT] Such factors are only included in the GDP and sectoral output forecasts. But different developments may be assumed for simulating scenarios.

**Question 7: Which classifications are in use at different stages of forecasting?**

[IHS] The sectoral classification is based on NACE (2-digits) but aggregated because of minimum cell size and national requirements. For occupational and educational classifications national classification systems were used in past projections. However, future projections will be made in accordance with ISCO (2-digits) and ISCED (level and programme destination), for compatibility with these classifications, although not each single occupation may be separately regarded (because of cell requirements).

[WIFO] The regional sectoral model uses the NACE 2-digit classification, but is aggregated because of cell size and national requirements. The occupational classification refers to ISCO and was aggregated to 61 occupations consequently it is not an exact one-to-one correspondence with ISCO.

[SYNT] The sectoral parts of the model refer to the NACE 2-digit classification (with some aggregations), occupations are classified by ISCO (1-digit) and national education levels.

**Question 8: Data sources and quality**

**(a) Which data and data sources are used at different stages of forecasting?**
**(b) Please indicate the quality of data input.**
**(c) Please mention the minimum length of time series required where applicable.**
**(d) Please – in sample surveys – specify the sample, its representativeness, and the regularity/frequency of the survey.**
**(e) Where data come from the national census, please indicate its frequency and possible combination with other data sources.**
**(f) How do you organise access to these data?**

[IHS] The data sources used are the macroeconomic sectoral employment forecasts for overall employment development based on data of the social security agency; and Austrian Mikrozensus data for projecting the employment structure by occupational and educational qualifications.

Employment data of the social security agency stem from an administrative register and include the whole population of all employed people (self-employed persons are taken from another data source). Hence, this is a reliable database with long-time series. The drawback of this database is a lack of occupational and educational information such that additional data sources must be matched for assessing skill needs. Further, in the past only aggregated data were generally available. More recently access to data on individuals is possible.

The Austrian *Mikrozensus*, which is identical to the LFS since 2004, is naturally confronted with sampling errors and other survey errors. Data are collected on a regular weekly basis such that per quarter 22 725 households (approximately 50 000 persons representative of the whole Austrian population) are reached. Each household participates for a year in the micro census, where the first interview is face-to-face and the following four are telephone interviews (CAPI). Generally, the quality of the new survey (until 2004) was raised, although the sample size was reduced. Besides this recent reorganisation there was another severe change in 1994 (especially in the sectoral classification), where longer time series contained structural breaks. Therefore, the

time series used in the model continue with the year 1994. This will complicate the forecast of skill needs in future due to the structural break.

A drawback of using two different data sources is that employment data are not perfectly comparable since there are, for example, slightly different definitions of employment status and regional concepts.

On data access, the aggregated employment data of the social security agency are directly accessible via the WIFO-database. The quarterly LFS have to be bought from Statistics Austria.

[WIFO] the WIFO-method uses the same data sources as the IHS-method (see the above explanations).

[SYNT] The model uses an integrated database, which consists of individual data of the social security agency (employed), the public employment service (unemployed) and imputed structural information from the LFS, earnings and income tax statistics. All these data are integrated into one database of individual data (with real and fictional, i.e. imputed entries) which is updated monthly. Data of the social security agency and the LFS are described above.

The major advantage of the Synthesis Forschung model is use of individual data of the social security agency. Access to these data was supported by the Austrian public employment service and was exclusively granted to the Synthesis Forschung employment projections. More recently access was opened up to some extent to research institutions by the Ministry of Economics and Labour.

**Question 9: What is the output of the forecast?**

[IHS] Organisation of the output refers to the forecast steps described above:

(a) time series of overall and sectoral employment by NACE. To achieve minimum cell size and national requirements the NACE 2-digit classification is aggregated to 29 sectors at least. A predefined minimum cell size does not exist;

(b) comprehensive output is generated (occupations are classified according to the national classification, not compatible with ISCO):

  (i) time series of employed persons for each occupation and sector (employment matrix: occupations *x* sectors);

  (ii) occupational and sectoral share effects for the historical and projection periods;

  (iii) the contribution of each sector to employment growth within each occupation (contribution matrix: occupation *x* sectors);

(c) the time series of employment by occupation is further structured by educational attainment (employment matrix: occupations *x* educational attainment in national classifications).

The output of data tables and matrices is extended by visual displays of time series and rankings of sectors and occupations.

The number of sectors and occupations depend on the number of available observations, i.e. the cell size. Cell sizes are much smaller for regional than national forecasts. Hence, due to cell size and national requirements the national projection has 29 sectors and 58 occupations and 6 educational levels. To avoid too small cell sizes with regional data, classifications are restricted to around 20 sectors, 23 occupations and 6 educational levels. Predefined minimum cell sizes do not exist.

[WIFO] The output of the regional WIFO-model with relevance to skill needs forecasts consists of the following components:

(a) time series of overall and sectoral employment in Austria by NACE 2-digit classification;

(b) time series of overall and sectoral regional employment (Upper Austria) by NACE 2-digits, combined to 34 sectors due to cell size and national requirements;

(c) time series of sectoral employment for each of the 61 occupations according to the ISCO classification with some aggregations due to cell size requirements (employment matrix: occupations *x* sectors) and decomposition of the occupational employment growth into a sectoral and occupational effect.

Predefined minimum cell sizes are not specified.

[SYNT] The employment output of the Synthesis Forschung model is organised in different employment forecast tables (not all tables are contained in each report):

(a) time series of overall employment and unemployment;

(b) projected employment by regions (9 provinces) *x* gender;

(c) projected employment by sector (at least 17 categories, NACE) *x* gender;

(d) projected employment by educational attainment (7 categories, national classification) *x* gender;

(e) projected employment by age (9 categories) *x* gender;

(f) projected unemployment by region, age, educational attainment and gender.

**Question 10: What is the period of the forecast?**

[IHS] In general the employment figures are projected for five years. Projections over five years ahead are avoided because the time series are too short for a reliable long-term projection.

[WIFO] The projection period is eight years at most.

[SYNT] The projection period varies between two and four years.

**Question 11: How often is the forecast repeated?**

[IHS] The forecast is not made regularly, but it has been made for different provinces, Lower Austria and Vienna. Until today this projection approach has been used five times.

[WIFO] The regional forecast should be made regularly for one province (Upper Austria, four-year intervals).

[SYNT] The forecast is repeated annually.

**Question 12: Are there procedures for the *ex post* evaluation of the quality of results of the forecast?**

[IHS] For two forecasts there were internal *ex post* evaluations. For the first forecast projection intervals were estimated by simulation for each occupation. Hence, after five years an *ex post* evaluation was possible by checking how many 'real' figures were covered by the confidence interval. For a second forecast the 'real' figures were compared to the projected ones by

checking the correspondence of occupational trends (growth or shrinkage) and by the method of the first study (assuming unchanged standard errors).

Assessing the forecast's robustness is done by a kind of sensitivity analysis. Therefore, some parameters of forecasting procedures are systematically varied and their influence on output is observed.

[WIFO] For testing the reliability of the forecast model an 'out-of-sample' forecast is carried out, i.e. the last available historical employment data are projected without using these data in the model (out-of-sample). This comparison assumes a similar development of the occupational employment structure in Austria and the US (which was historically given).

[SYNT] There is no documentation on *ex post* evaluations.

**Question 13: What is the use/target group of the forecast?**

[IHS] The projections are made for labour-market institutions (Austrian public employment service, Austrian chamber of labour) and for educational institutions (particularly regional coordination institutions of polytechnic universities). The forecasts serve as guidance for assessing future skill needs and planning adjustments to educational fields, for example, the potential for new polytechnic universities.

[WIFO] The projections are mainly used by the Upper-Austrian Chamber of Labour for planning regional labour-market and educational policy.

[SYNT] The projection is a policy planning tool for the Austrian Public Employment Service.

**Question 14: Who does the forecast?**

[IHS] The sectoral forecast is obtained from WIFO. The occupational and educational employment projection is done by IHS.

[WIFO] All steps of the forecast are undertaken by WIFO.

[SYNT] With the exception of the macroeconomic forecasts of GDP and sectoral output, projections are calculated by Synthesis Forschung.

**Question 15: Who pays for the forecasting work and the necessary data?**

[IHS] Forecasts are commissioned by other institutions (Austrian Public Employment Service, Austrian Chamber of Labour, regional coordination institutions of polytechnic universities). In general, data are paid for by IHS because they are also used for other research activities.

[WIFO] Forecasts are commissioned by the Upper-Austrian Chamber of Labour. Data are paid for by WIFO.

[SYNT] Forecasts are commissioned by the Austrian Public Employment Service which also delivers the main data.

**Question 16: What are your ideas for establishing a forecasting approach at European level? How should this activity be organised and cooperation arranged, who should be involved, should there be a platform (e.g. at Cedefop) for cooperation?**

There may be different strategies for establishing a forecasting approach at European level. One starting point is the different forecasting practices in Member States, which partly depend on different levels of data availability and quality. Some Member States are clearly ahead of others, and learning from one another should be supported. Overall strategies to level out variety and

lead to compromise and 'regression to the mean' at a mediocre level of quality should be avoided. The best method for achieving high quality practice is to establish a European network of forecasting institutions, e.g. in the Community's framework programmes.

The (further) development of national practices would be a key point in this strategy, which is clearly necessary from the point of view of Austrian practice. There should also be some variety in the approaches applied, and cross-national application of certain practices would be interesting. Improving databases could also been achieved by that strategy. The question of feasible classifications at European and Member State levels is an important question. To what extent do we need different classifications? If different classifications are needed, how can we make them comparable across levels? What kinds of measurement of skills are the most feasible and do we need different descriptors (attainment levels, education fields, occupations, or new descriptors as 'work skills', or 'competences'). To some extent these questions are related to the European qualification framework and national qualification frameworks.

Another, and complementary strategy is setting up a European forecast, using commonly available data, which although more crude, could provide some comparative yardsticks to feed into national debates and assessment procedures. Such a procedure at European level (with some similarities to the innovation scoreboard, or the *Employment in Europe* or *Competitiveness report*) could probably be developed more easily than a harmonised strategy. Interaction and learning from European and national practices on procedures and data could emerge.

All countries should base their standard models on common comparable data sources and classifications. One option is using the national LFS in combination with either the 28 two-digit ISCO occupations or the 25 two-digit fields of education (ISCED 97). Especially use of the new ISCED fields of education classification might be suitable for compatible comparisons of demand and supply of skills, at least for education and training systems which provide more specialised qualifications. In Austria a comprehensive study of anticipation of the matching of supply and demand for qualifications was carried out (Lassnigg and Markowitsch, 2005). One of the results was a lack of an agreed and commonly used classification of qualification supply and demand. As follow-up, a feasible classification based on ISCED fields (which have been refined by Cedefop) will be developed.

An important issue for developing forecasting systems is the choice between more realistic complex models (e.g. micro prognosis, as recommended by Wilson, 2001) and more crude and simple (projection) models, which are less realistic, but which make assumptions more visible and transparent, and can be more easily replicated.

Another important point is linking skill needs forecasts to overall and sectoral employment projections from macroeconomic forecast models, which consider all economic development.

Identifying a best skill needs forecasting model is probably not possible, but efforts to coordinate and exchange experiences should be promoted.

# Annexes

## [IHS] Classification of occupations (national classification)

| No. | Occupations | No. | Occupations |
|---|---|---|---|
| 1 | Agricultural and forestry engineering professionals | 29 | Hotel and restaurant managers |
| 2 | Agricultural, forestry and fishery workers | 30 | Hotel and restaurant service workers |
| 3 | Miners and related workers | 31 | Cooks and kitchen service workers |
| 4 | Stone cutters, ceramics, glass workers, and related workers | 32 | Housekeeping workers, building caretakers |
| 5 | Building workers | 33 | Chimney-sweeper and building cleaning service workers |
| 6 | Metal moulders, welders, sheet-metal workers, and related trades workers | 34 | Chemical cleaners, launderers |
| 7 | Blacksmiths, tool-makers and related trades workers | 35 | Other cleaners |
| 8 | Metal-products machine operators | 36 | Hairdresser and related service workers |
| 9 | Plumbers and tinsmiths | 37 | Other service workers |
| 10 | Mechanics and related workers | 38 | Architects, building engineers and related professionals |
| 11 | Other metal workers | 39 | Machine and electrical engineers |
| 12 | Electricians | 40 | Chemists, physicists and related technicians |
| 13 | Wood treaters, cabinet-makers and related trades workers | 41 | Computing and computer associate professionals |
| 14 | Textile and leather workers | 42 | Mining engineers and related technicians |
| 15 | Garment workers | 43 | Other technicians |
| 16 | Shoemaking trades workers | 44 | Draughtsmen |
| 17 | Wood-processing- and papermaking-plant operators | 45 | Administrative (associate) professionals |
| 18 | Designer (printing trade) | 46 | Protective services workers |
| 19 | Chemical, rubber and plastic products workers | 47 | Legal and business professionals |
| 20 | Food and related products machine operators | 48 | Managers, directors and chief executives |
| 21 | Machine operators | 49 | Numerical clerks, cashiers and related workers |
| 22 | Transport, manufacturing and other labourers | 50 | Other office and administrative clerks |
| 23 | Traders and market sales persons | 51 | Health professionals and health service workers |
| 24 | Travelling salesmen, business services agents | 52 | Social work associate professionals |
| 25 | Transport agents | 53 | Religious (associate) professionals |
| 26 | Telecommunication agents | 54 | Teaching (associate) professionals |
| 27 | Carrier and tourism agents | 55 | Scientists and related professionals |
| 28 | Messengers and related service workers | 56 | Journalists, interpreters, writers |
| | | 57 | Artists, musicians and entertainers |
| | | 58 | Other occupations (not allocated) |

## [IHS] Classification of educational attainment (national classification)

| No. | Educational attainment |
|---|---|
| 1 | Compulsory school (primary schools, lower secondary schools) |
| 2 | Apprenticeship |
| 3 | Secondary technical and vocational schools |
| 4 | Secondary academic schools |
| 5 | Secondary technical and vocational colleges |
| 6 | Universities, polytechnic universities, post-secondary courses |

## [WIFO] Classification of occupations (ISCO 88 three-digits)

| No. | ISCO | Occupations |
|---|---|---|
| 1 | 111-114 | Legislators and senior officials of governments and special-interest organisations |
| 2 | 121 | Directors and chief executives |
| 3 | 122-123 | Production and operations managers, other specialist managers |
| 4 | 131 | Managers of small enterprises |
| 5 | 211-213 | Physicists, chemists, mathematicians, statisticians, computing professionals and related professionals |
| 6 | 214 | Architects, engineers and related professionals |
| 7 | 221-223 | Life science professionals, health professionals (except nursing), nursing and midwifery professionals |
| 8 | 231 | College, university and higher education teaching professionals |
| 9 | 232 | Secondary education teaching professionals |
| 10 | 233-235 | Primary and pre-primary education teaching professionals, special education teaching professionals, other teaching professionals |
| 11 | 241 | Business professionals |
| 12 | 242 | Legal professionals |
| 13 | 243-244 | Archivists, librarians and related information professionals, social science and related professionals |
| 14 | 245-246 | Writers and creative or performing artists, religious professionals |
| 15 | 247 | Public service administrative professionals |
| 16 | 311 | Physical and engineering science technicians |
| 17 | 312 | Computer associate professionals |
| 18 | 313-315 | Optical and electronic equipment operators, ship and aircraft controllers and technicians, safety and quality inspectors |
| 19 | 321 | Life science technicians and related associate professional |
| 20 | 322 | Health associate professionals (except nursing) |
| 21 | 323 | Nursing and midwifery associate professionals |
| 22 | 331-334 | Teaching associate professionals |
| 23 | 341 | Finance and sales associate professionals |
| 24 | 342 | Business services agents and trade brokers |
| 25 | 343 | Administrative associate professionals |
| 26 | 344-345 | Customs, tax and related government associate professionals, police inspectors and detectives |
| 27 | 346 | Social work associate professionals |
| 28 | 347-348 | Artistic, entertainment and sports associate professionals, religious associate professionals |
| 29 | 411 | Secretaries and keyboard-operating clerks |
| 30 | 412 | Numerical clerks |
| 31 | 413 | Material-recording and transport clerks |
| 32 | 414 | Library, mail and related clerks |
| 33 | 419 | Other office clerks |
| 34 | 421 | Cashiers, tellers and related clerks |
| 35 | 422 | Client information clerks |
| 36 | 511,514 | Travel attendants and related workers, Other personal services workers |
| 37 | 512 | Housekeeping and restaurant services workers |
| 38 | 513 | Personal care and related workers |
| 39 | 516 | Protective services workers |
| 40 | 521-522 | Fashion and other models, shop, stall and market salespersons and demonstrators |
| 41 | 611-615 | Skilled agricultural and fishery workers |
| 42 | 711-712 | Miners, shot firers, stone cutters and carvers, building frame and related trades workers |
| 43 | 713 | Building finishers and related trades workers |
| 44 | 714 | Painters, building structure cleaners and related trades workers |
| 45 | 721 | Metal moulders, welders, sheet-metal workers, structural-metal preparers, and related trades workers |
| 46 | 722 | Blacksmiths, tool-makers and related trades workers |
| 47 | 723 | Machinery mechanics and fitters |
| 48 | 724 | Electrical and electronic equipment mechanics and fitters |
| 49 | 731-733 | Precision workers in metal and related materials, potters, glass-makers and related trades workers, handicraft workers in wood, textile, leather and related materials |
| 50 | 734 | Craft printing and related trades workers |
| 51 | 741 | Food processing and related trades workers |
| 52 | 742 | Wood treaters, cabinet-makers and related trades workers |
| 53 | 743-744 | Textile, garment and related trades workers, pelt, leather and shoemaking trades workers |
| 54 | 811-817 | Stationary plant and related operators |
| 55 | 821-827, 829 | Machine operators (without assemblers) |
| 56 | 828 | Assemblers |
| 57 | 831-834 | Drivers and mobile plant operators |
| 58 | 911-916 | Sales and services elementary occupations |
| 59 | 921 | Agricultural, fishery and related labourers |
| 60 | 931-933 | Labourers in mining, construction, manufacturing and transport |
| 61 | 100 | Armed forces |
| 62 | 999 | Not allocated |

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# Cyprus

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This paper presents the methodological approach implemented in Cyprus for producing occupational employment forecasts.

The studies can be obtained from the Human Resource Development Authority (HRDA) of Cyprus and they are also available from its website (www.hrdauth.org.cy).

**Question 1: How are 'skills' defined in skill needs forecasting approaches in your country?**

In the forecasting approach used in Cyprus, skills refer to occupational skills. Thus, forecasts are provided for occupations using the ISCO 88 (COM) classification system.

**Question 2: Which main method is currently used for mid/long-term forecasting of skill needs at macroeconomic level in your country?**

The methodology used for the long-term forecasting of skill needs in Cyprus is divided into six main stages, which at the end provide forecasts for total demand (expansion and replacement demand) in 198 occupations for the period 2005–15. These six stages are described analytically in the annex. HRDA produces these forecasts in close collaboration with the Planning Bureau, while the Statistical Service provides the necessary data.

**Question 3: Which methods/models are used for the input information on macroeconomic forecasting and (sectoral) employment projections?**

The Planning Bureau produces forecasts on the value added at constant prices and the labour productivity of economic sectors leading to employment forecasts for 44 economic sectors. Forecasts are based on developments of the external environment, given its small size, the expected developments concerning competitiveness, anticipated government policy, developments regarding factors of production, labour and capital and their productivity, based mainly on recent trends.

**Question 4: Does the skill needs forecasting method only include forecasts of total demand or also expansion demand and replacement demand?**

Forecasts are provided for both expansion demand and replacement demand.

**Question 5: Does the method consider the supply side, and possibly interactions between supply and demand?**

The methodology used does not provide any estimates for the supply of persons into these economic sectors or occupations.

**Question 6: Does the approach also consider (exogenous) factors such as impact of technologies, work organisation, socioeconomic conditions, globalisation/ relocation of jobs, etc.?**

The impact of these factors is considered in the forecasts of the Planning Bureau on the value added at constant prices and the labour productivity of economic sectors.

Additionally, forecasts of the structure of employment consider past trends affected by these factors.

**Question 7: Which classifications are in use at different stages of forecasting?**

Economic sectors are classified according to the NACE Revision 1 classification system used by the EU. The breakdown by level of analysis of the 44 economic sectors used in the forecasts is as follows:

(a) 11 economic sectors at first level of analysis (one digit);

(b) 33 economic sectors at second level of analysis (two digits).

Occupations are classified according to the ISCO 88 (COM) classification system. The breakdown by level of analysis of the 198 occupations used in the forecasts is as follows:

(a) 2 occupations at first level of analysis (one digit);

(b) 4 occupations at second level of analysis (two digits);

(c) 45 occupations at third level of analysis (three digits);

(d) 147 occupations at fourth level of analysis (four digits).

**Question 8: Data sources and quality**

**(a) Which data and data sources are used at different stages of forecasting?**
**(b) Please indicate the quality of data input.**
**(c) Please mention the mininum length of time series required where applicable.**
**(d) Please – in sample surveys – specify the sample, its representativeness, and the regularity/frequency of the survey.**
**(e) Where data come from the national census, please indicate its frequency and possible combination with other data sources.**
**(f) How do you organise access to these data?**

The following data are used at the various stages of forecasting:

(a) Census of population
The Statistical Service carries out these censuses every 10 years. All households and dwellings in Cyprus are visited and information is collected on the demographic and social characteristics of the population and households, on the size and amenities of dwellings and the geographic distribution of the population, households and dwellings. Data used in forecasting are characteristics of the employed population and specifically their occupation and the economic sector of the enterprise in which they are employed. The last population census was conducted in 2001.

(b) Census of establishments
The Statistical Service conducts these censuses every five years. All business establishments in Cyprus are visited and information is collected. Censuses contain information on enterprises such as economic sector, number of employees and geographical region, as well as information on the persons employed such as status, occupation and gender. These censuses cover all economic sectors except agriculture, hunting and forestry and fishing.

(c) LFS
The Statistical Service conducted these surveys annually from 2000 to 2003 and quarterly from 2004 onwards. These are based on the regulations set by the EU. They are sample-based surveys where information is collected in a sample of private households, allocated according to the number of households that reside in urban and rural areas. The data used in the forecasting exercise are the characteristics of the employed population and specifically

their occupation and the economic sector of the enterprise in which they are employed. Additionally, the reasons why people left the labour market and their previous employment are used.

The high quality and reliability of these data is safeguarded by the rules and regulations of the Statistical Service and by implementing the relevant EU regulations.

For forecasting the structure of employment, the relevant comparable data for a 10-year period were considered to be appropriate.

LFS has been conducted annually from 2000 to 2003 and quarterly since 2004. It covers a sample of 3 500 households in all districts of Cyprus, which are allocated according to the number of households that reside in urban and rural areas. Thus, information is collected from around 10 500 persons from a total population of around 690 000.

HRDA receives these data in electronic format from the Statistical Service for a fee.

**Question 9: What is the output of the forecast?**

The methodology is described analytically in annex. The output at each stage of the methodological approach is shown below:

Stage 1: employment forecasts for 44 economic sectors (NACE: 11 at first level of analysis and 33 at second level of analysis) in full-time equivalent persons.

Stage 2: employment forecasts for 44 economic sectors (NACE: 11 at first level of analysis and 33 at second level of analysis) in persons.

Stage 3: employment forecasts for 27 occupational groups (ISCO 88 (COM): 27 at second level of analysis) in 17 main economic sectors (NACE: 17 at first level of analysis) in persons.

Stage 4: employment forecasts for 198 occupations (ISCO 88 (COM): 2 at first level of analysis, 4 at second level of analysis, 45 at third level of analysis and 147 at fourth level of analysis).

Stage 5: replacement forecasts for 198 occupations (ISCO 88 (COM): 2 at first level of analysis, 4 at second level of analysis, 45 at third level of analysis and 147 at fourth level of analysis).

Stage 6: total demand for 198 occupations (ISCO 88 (COM): 2 at first level of analysis, 4 at second level of analysis, 45 at third level of analysis and 147 at fourth level of analysis).

**Question 10: What is the period of the forecast?**

The model provides annual forecasts for both economic sectors and occupations. The forecasting period is 10 years. Forecasting results are usually presented both for the final year of the 10-year period and for the middle year, that is year five of the 10-year period.

**Question 11: How often is the forecast repeated?**

The forecast is repeated every five years.

**Question 12: Are there procedures for the *ex post* evaluation of the quality of results of the forecast? How do you assess the quality (accuracy, reliability, robustness) of the output?**

Forecasts will be evaluated every five years prior to their repetition. They will be compared with the actual situation extracted from the two censuses.

**Question 13: What is the use/target group of the forecast?**

The main users of forecasts are the following:

(a) policy-makers, such as the Planning Bureau, the Ministry of Finance, the Ministry of Education and Culture and the Ministry of Labour and Social Insurance, use these forecasts to determine appropriate policy responses for adapting to the forecast situation in the labour market;

(b) public and private organisations involved in human resource planning such as the Public Employment Services and the social partners (employers' organisations and trade unions) use these forecasts in their work;

(c) people involved in counselling such as secondary education vocational guidance teachers use these forecasts as a tool for providing advice and counsel;

(d) the public in general and more specifically parents and students wishing to choose an occupation or to pursue further studies.

**Question 14: Who does the forecast?**

The Planning Bureau produces the annual forecasts of the percentage changes for the value added at constant prices and the labour productivity of the economic sectors leading to employment forecasts for 44 economic sectors.

HRDA produces forecasts for the structure of employment in each of the 17 main economic sectors and forecasts for employment in 198 occupations.

Additionally, HRDA produces forecasts for replacement demand for 17 main economic sectors and 198 occupations.

These forecasts are not produced in isolation as there is a good working relationship between the two organisations, resulting in cooperation and discussion about producing the forecasts.

**Question 15: Who pays for the forecasting work and the necessary data?**

The two organisations involved in the forecasts are the Planning Bureau and HRDA. They cover their own relevant costs, while the Statistical Service provides all the necessary data to HRDA in electronic format for a specified fee.

**Question 16: What are your ideas for establishing a forecasting approach at European level? How should this activity be organised and cooperation arranged, who should be involved, should there be a platform (e.g. at Cedefop) for cooperation?**

This will be an extremely difficult task as it will demand the sustained effort and cooperation of all EU countries and most probably will take many years to materialise.

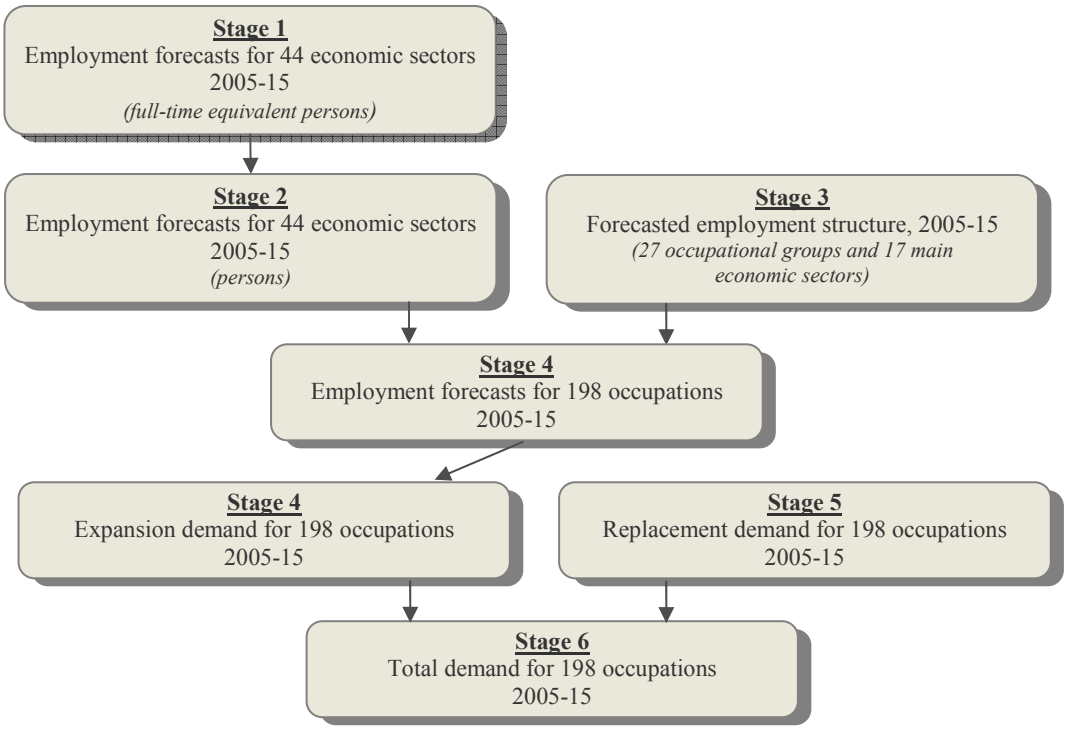
As data in various countries are still different and as the methods currently adopted differ depending on data availability, the allocated resources and the country size, it would appear impossible to define at present exactly the same forecasting exercise to be implemented in all countries.

Therefore, better results will be obtained if efforts focus at present on output. EU countries could agree on a common minimum output of the forecasting exercise in terms of economic sectors, occupations, length of the forecasting period and the frequency of forecasts. This agreement could be implemented and monitored by Cedefop. This will also be a long process and, therefore, a working group could be formed under the auspices of Cedefop/Skillsnet to pursue this objective.

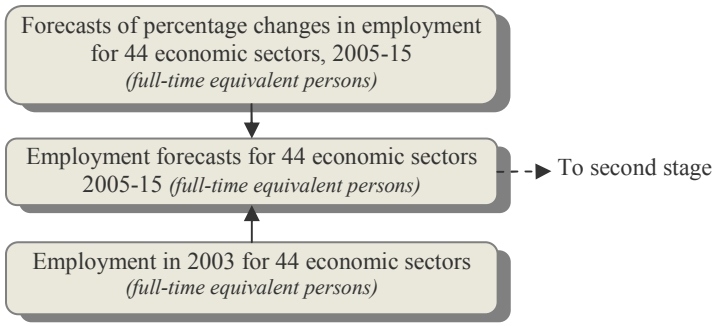
Skills forecasting at European level could be effected at present by aggregating forecasts at national level based on predefined minimum criteria as indicated above.

# Annex: Methodology for the long-term forecasting of skill needs in Cyprus

The methodology used for the long-term forecasting of skill needs in Cyprus is divided into six main stages, which at the end provide forecasts for total demand (expansion and replacement demand) in 198 occupations for the period 2005–15. These six stages are depicted in the diagram below and described analytically in the following pages. HRDA produces these forecasts in close collaboration with the Planning Bureau, while the Statistical Service provides the necessary data.




**Stage 1: employment forecasts by economic sector (full-time equivalent persons)**



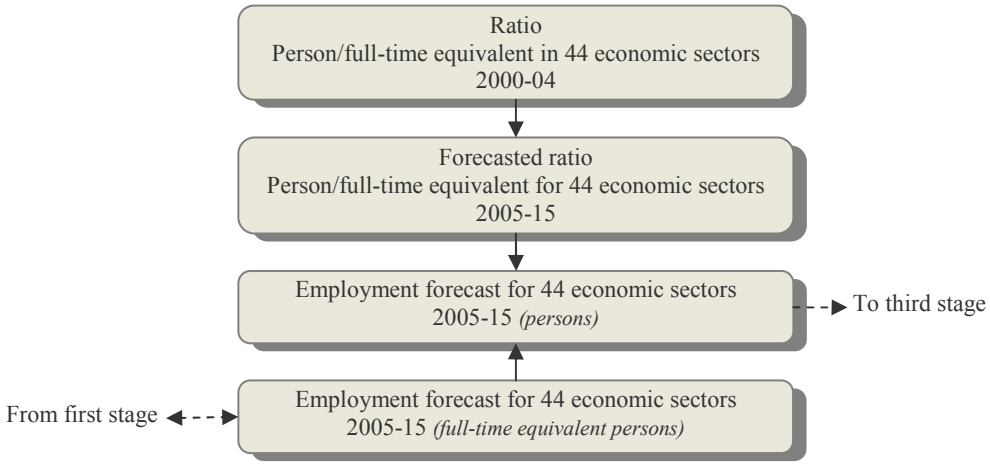

The Planning Bureau in consultation with HRDA produces annual forecasts for the percentage changes of value added, at constant prices, labour productivity and employment for each economic sector, for a 10-year period. Employment refers to full-time equivalent persons. In the latest study these forecasts covered 44 economic sectors for the period 2005-15.

Forecast annual employment changes are applied by HRDA on the latest available data of employment by economic sector, which are provided by the Statistical Service. These are

annual data contained in the labour statistics and refer to full-time equivalent persons. For the 2005-15 forecasts the latest available data were for 2003.

Output of this stage is providing annual employment forecasts in full-time equivalent persons for 44 economic sectors for the period 2005-15.

**Stage 2: employment forecasts by economic sector (persons)**

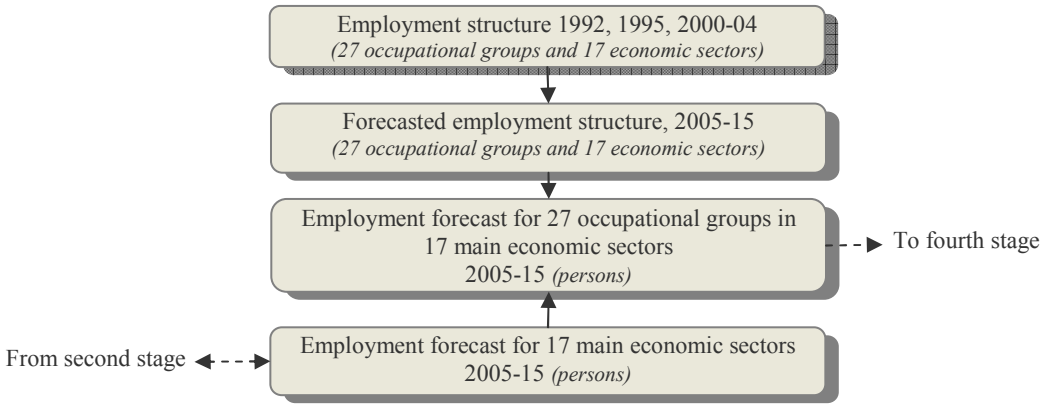



Employment forecasts in full-time equivalent persons are transformed into number of persons during this stage. Data from the LFS are used to calculate the ratios of employed persons to full-time equivalent persons for each of the 44 economic sectors for 2000 to 2004.

Based on these past data, ratios were estimated for each year of the period 2005-15. These estimates were based on a linear regression method except where that method provided strange or negative values. In those few cases the ratio of 2004 was applied for all the years of the period 2005-15.

Output of this stage is providing annual employment forecasts for the number of persons for 44 economic sectors for the period 2005-15.

**Stage 3: structure of employment**




To forecast the structure of employment for the period 2005-15, sector/occupation matrices were used. The matrices that could be used were those for the years 1992, 1995, 2000, 2001,

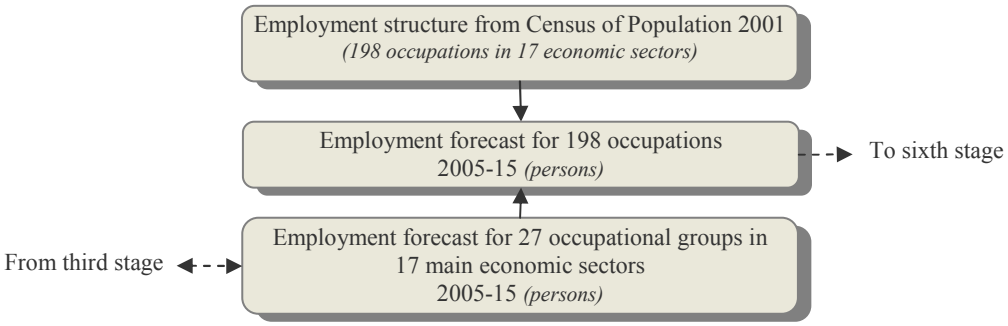
2002, 2003 and 2004. In preparing these matrices data were used from the population census (1992 and 2001), the census of establishments (1995 and 2000) and the LFS (2002, 2003 and 2004). Each matrix has 459 cells as it contains employment in 17 main economic sectors and 27 occupational groups.

Matrices could not be prepared for earlier years as the classification systems used by the Statistical Service were changed. Since 1992, the classification system for economic sectors is the NACE Revision 1 instead of ISIC 68, which was previously used. Also since 2000, the classification system for occupations is the ISCO 88 (COM) instead of ISCO 88, which was previously used. The 1992 and 1995 matrices were adjusted to compensate for the slight differences among the ISCO 88 (COM) and the ISCO 88 classification systems.

The matrices are then filled with the shares of employment by occupation in each economic sector. These are used for forecasting the structure of employment for each year for the period 2005-15. The method applied is linear regression using the natural logarithm *ln* for the time variable on each one of the 459 cells of the matrices. This method was not valid in the cells where the number and shares of employment was too small and in these cases necessary adjustments to the expected shares were made. This process culminates in forecasts of the shares of employment by occupation in each economic sector.

By applying the projected shares of the 27 occupational groups to the employment forecasts for the 17 main economic sectors, forecasts for employment in these occupational groups are obtained for each year of the period 2005-15.

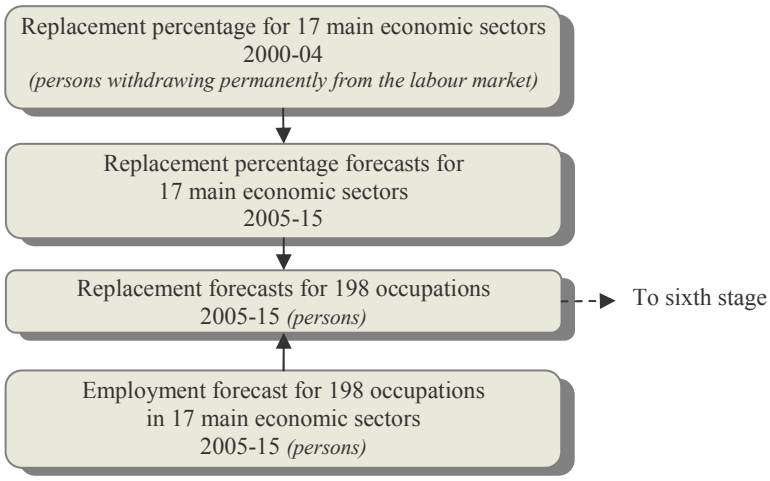
**Stage 4: employment forecasts by occupation**




To provide employment forecasts by occupation at the third and fourth level of analysis the structure of employment obtained from the 2001 population census is used. The population census was considered as the latest available reliable source, as data from the LFS could not be reliably used at this level of analysis. Further, changes in the structure of employment were not significant at the third and fourth levels although these were considered at the first and second levels.

Therefore, by applying the 2001 shares of occupations to the forecasts for the 27 occupational groups in the 17 main economic sectors, forecasts for 198 occupations (2 at first level of analysis, 4 at second level of analysis, 45 at third level of analysis and 147 at fourth level of analysis) were obtained.

**Stage 5: forecasts of replacement demand by occupation**

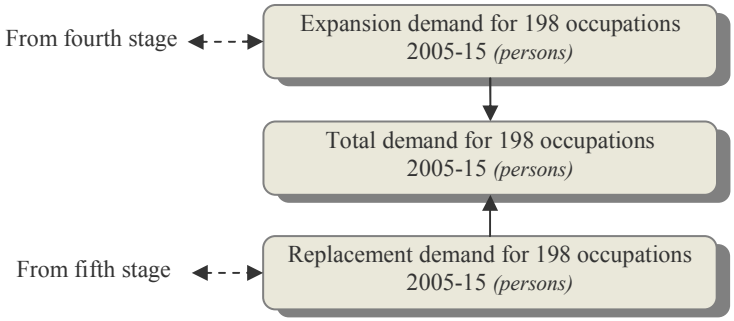



To forecast replacement demand by occupation the percentage of persons withdrawing permanently from the labour market for each of the 17 main economic sectors was calculated for the years 2000 to 2004. Data from the annual LFS were used for calculating that percentage. Three reasons were considered as permanent withdrawals from the labour market: retirement, personal or family responsibilities and personal illness or disability.

Using the percentages for the years 2000 to 2004 forecasts of the replacement percentage for the 17 main economic sectors were estimated for the period 2005-15. The method used entails calculating weighted averages giving more weight to the latest years (2004:40 %, 2003:30 %, 2002:15 %, 2001:10 %, 2000:5 %).

Due to lack of additional occupational data the forecast replacement percentages for each of the 17 main economic sectors were uniformly applied to all the occupations of those sectors. Using these percentages replacement demand was forecast for the 198 occupations for all the years of the period 2005-15.

**Stage 6: forecasts of total demand by occupation**




Finally, to forecast total demand for 198 occupations, expansion demand (difference in employment levels) was added to replacement demand due to persons withdrawing permanently from the labour market.

# Czech Republic

*Ludvik Michalicka; Research Institute for Labour and Social Affairs*

The model used for forecasting skill needs in the Czech labour market has been adapted from the model of the Dutch Centre for Education and the Labour Market (ROA) by the Centre for Economic Research and Graduate Education of Charles University (CERGE – EI) in Prague. This model forecasts the demand and supply side of the labour market separately for any given educational and occupational group in the medium term. Historical data used in this model are derived from the period of transition of the Czech economy from central planning to a market system. This caused particular difficulties.

**Question 1: How are 'skills' defined in skill needs forecasting approaches in your country?**

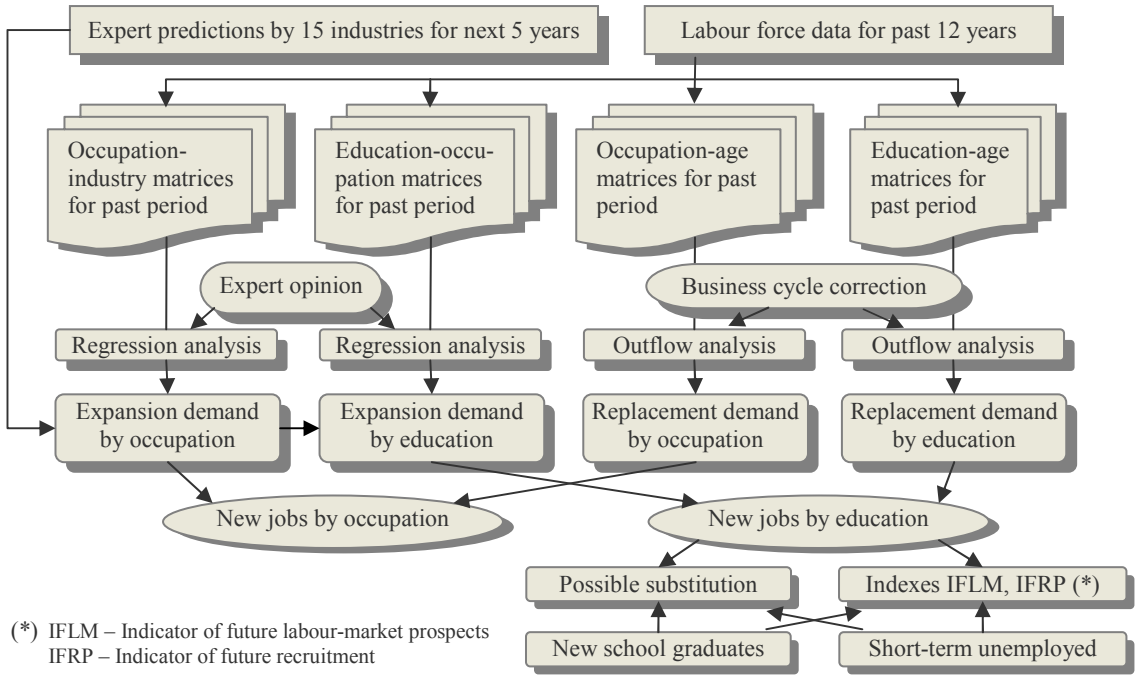
Defining skills has changed repeatedly during work with the model. The basic requirement – to provide a classification that considers the current breakdown of the labour market – was the subject of several compromises. The resulting classification is, therefore, derived from a combination of the current educational classification used in the LFS prepared by the Czech Statistical Office, the ISCED and those categories used in school leaver data provided by the Ministry of Education.

At present our model uses 30 educational categories.

**Question 2: Which main method is currently used for mid/long-term forecasting of skill needs at macroeconomic level in your country?**

The methodology considers information on the prospect of individual workers finding a job or information concerning the prospect of recruiting a worker with a given qualification in a defined period of time. The estimation of such a chance is based on comparison of the demand for workers with any given qualification and the inflow of school-leavers, both in five-year time periods. Note that estimating the demand side is crucial and constitutes the most complicated part of the problem.

The model works as follows:




(*) IFLM – Indicator of future labour-market prospects
IFRP – Indicator of future recruitment

**Question 3: Which methods/models are used for the input information on macroeconomic forecasting and (sectoral) employment projections?**

The model assumes knowledge of forecasting employment in four sectors classified according to NACE: manufacturing, market services, agriculture and non-market services. This forecast is further subdivided into the more detailed NACE classification.

At present, there is no regular updated macroeconomic forecast available in the Czech Republic based on any regular macroeconomic model and which conforms to the requirements of the model. Therefore, it relies on ad hoc expert forecasting of employment in the 16 major NACE defined industries. The forecasting model is further subdivided into 50 occupational clusters.

**Question 4: Does the skill needs forecasting method only include forecasts of total demand or also expansion demand and replacement demand?**

Estimating demand for workers is the most complicated part of the model. Total demand is made up of three parts:

(a) replacement demand is part of total demand and is concerned particularly with replacing retired people. A job position is still available for a new employee. An estimation of the replacement demand of an educational or occupational cluster is related to employment development in the previous five-year period. Employees in the cluster are divided into five-year cohorts whereupon the appropriate cohorts at the beginning and end of the last five-year period are compared. If a decrease is detected, we can assume, after all the other conditions are satisfied, that such workplaces are available. Difficulties appear as a result of small frequencies of certain age cohorts and, therefore, in the large variance in replacement demand of certain educational or occupational clusters;

(b) expansion demand describes a change in the employment level of a given occupation or educational cluster over a defined period of time. Initially, the model computes the frequency of 50 occupational clusters as well as their predicted development using a macro prediction of the relevant industries. Subsequently, a prediction of 30 educational clusters is computed;

(c) substitution demand is the additional demand for people with a given educational profile who can fill vacant job positions requiring a different type of education. Substitution is possible only between educations that have a similar occupational structure. In other words, substitution occurs between educational types within one specific occupation. In this way only those people with related types of education can substitute each other.

The aggregate of replacement demand, expansion demand and substitution demand makes up total demand for each occupational or educational cluster.

**Question 5: Does the method consider the supply side, and possibly interactions between supply and demand?**

The supply side consists of the inflow of school-leavers plus an appropriate portion of short-term unemployed people.

**Question 6: Does the approach also consider (exogenous) factors such as impact of technologies, work organisation, socioeconomic conditions, globalisation/relocation of jobs, etc.?**

The model has not yet used any exogenous factors.

**Question 7: Which classifications are in use at different stages of forecasting?**

Educational level classification is based on the ISCED scale (first digit) and the field of study is coded by the unique Czech Statistical Office classification. The educational classification employed is a combination of these two characteristics and complies with school-leaver classes.

Occupational classification is adequate to two digits of the ISCO 88 code.

**Question 8: Data sources and quality**

**(a) Which data and data sources are used at different stages of forecasting?**
**(b) Please indicate the quality of data input.**
**(c) Please mention the minimum length of time series required where applicable.**
**(d) Please - in sample surveys - specify the sample, its representativeness, and the regularity/frequency of the survey.**
**(e) Where data come from the national census, please indicate its frequency and possible combination with other data sources.**
**(f) How do you organise access to these data?**

The most important statistical data source available is the quarterly labour force survey (LFS) compiled by the Czech Statistical Office. The LFS is a continuous survey with results released quarterly. The questionnaire has been fully harmonised with Eurostat standards since 2002. The LFS is based on a sample of almost 30 000 households and includes all the residents (about 70 000). Data are weighted to respect the age structure of the population according to demographic projections. 20 % of the sample is replaced quarterly.

Problems arise when attempting to create a time series of frequencies. Complying with Eurostat standards has resulted in many changes to educational classification over the past eight years, so only five-year time series are available in some cases.

School-leaver data with a five year prediction are evaluated at the Ministry of Education, Youth and Sport (its Institute for Information on Education). Many school-leavers (especially from the upper-secondary level) do not immediately enter the labour market. A significant proportion of secondary-school-leavers enrol in higher education and some stay out of the labour market for other reasons. Therefore, school-leaver forecasts of anticipated flows into higher education must be corrected. To find the proportion of graduates who continue studying at universities, an extensive administrative data set on applicants to universities is used and it allows us to distinguish different applicant education types.

Information on several short-term unemployed people (those unemployed for less than one year) by educational category is taken from LFS data.

**Question 9: What is the output of the forecast?**

Computing total demand, an occupation *x* education table for each year of the history and the predicted interval is obtained. Educational categories have already been mentioned above. Currently there are 30. The two digit ISCO 88 code is used for defining occupational categories, several of which, for practical reasons, have to be merged (because of small frequencies). Currently 50 occupational categories are used.

Total demand by cluster is an important result, especially when expressed as a percentage of the total cluster frequency of the previous year.

The main result of the model is a set of key labour-market indicators. Indicators are defined as a ratio of total supply over total demand in an educational cluster in the estimated period of

time. It is difficult to interpret the indicators because of their random character. Estimating for a large cluster tends to be more accurate than for a small cluster.

**Question 10: What is the period of the forecast?**

The forecast period is five years. Such a length of time can provide useful information for students or advisors choosing a field of study and also for decision-makers who have to react to labour-market movements.

**Question 11: How often is the forecast repeated?**

At the moment the forecast is in process. Half a year's LFS data are usually projected onto the whole year. The plan is to provide the forecast biennially.

**Question 12: Are there procedures for the *ex post* evaluation of the quality of results of the forecast? How do you assess the quality (accuracy, reliability, robustness) of the output?**

The short history of available input data makes the model extremely sensitive. Adding new data changes the forecasts considerably, mainly for small clusters. By analysing large changes new biased frequencies are usually discovered which influence computation of replacement or expansion demand even when using robust regression methods.

Some results of the model (job shortage, inflow of school-leavers) were used to construct an 'average unemployment rate' over an estimated period and then compared with a statistical extrapolation of the unemployment rate computed using LFS data. Clusters with small frequencies were found to display the largest discrepancies.

**Question 13: What is the use/target group of the forecast?**

The current stage of development of the model and the data do not yet allow publishing results. Nevertheless, decision-makers have shown considerable interest in our work and have pledged continuing support. There is often demand for advice on regional forecasting.

# Cooperation and further development

The Research Institute for Labour and Social Affairs in Prague is working with the model and has received the go-ahead to work on further development. The team is working closely with the Center for Economic Research and Graduate Education of Charles University (CERGE-EI) and is preparing the groundwork for cooperation with statisticians at the Faculty of Mathematics and Physics at Charles University in Prague. The difficult task of organising expert opinion on multisectoral forecasting is being carried out by the National Training Fund in Prague.

The main aim is to create a statistical approach to forecasting; the model is based on LFS data, which consists of the random selection of information. Computation of the demand for work is based on selected frequencies (sometimes very small) which gives a statistical character to the results. The aim is to express resulting coefficients using statistical characteristics (distribution, mean, variance, interval of confidence, etc.).

The business cycle effect is now tested in the model. The business cycle is a periodical fluctuation in employment which has a short-term effect and does not affect the long-term development of employment. Since there was a downward effect caused by the business cycle in the 10-year period 1994 to 2004, it would be incorrect to make a linear extrapolation of

past trends since the negative effect should not be allowed to affect future predictions. Therefore, we separate the effect of the business cycle from the overall employment trend.

Following paragraphs describe the work at CERGE-EI:

(a) further development on computing the replacement demand. It is computed separately for males and females and then summed up. In this way specific gender differences across age cohorts on labour-market participation are captured. Further, computing replacement demand was extended to simulate the impact of shifts in retirement ages for men and women;

(b) new tool developed – methodology based on symmetric input-output matrices – is used to simulate the effect of larger investment projects (FDI) on the labour market. For example eight-billion investment to build a new sport stadium is considered;

(c) computing the number of school-leavers (those ready to enter the labour market) is improved. Based on registry of college applicants various flows of individuals to and from the labour market are identified. This allows for better predictors of future supply of school graduates in the whole model and also allows control for the impact of lifelong learning.

# Estonia

*Marek Lambing; Ministry of Economic Affairs and Communication, Economic Development Department*

Development of Estonian skill needs forecasting method is in a very early stage – the practical build-up process started just two years ago. The development process evolves step-by-step to be more applicable for educational and training needs forecasting. First forecast described the expansion of labour by business activity, current forecast includes all essential basic components for skill needs forecasting – new job creation, labour wastage (mortality and retirement), intrasectoral movement. Future developments are mainly concerned more with educational side, specifically how to translate economic needs to educational needs.

**Question 1: How are 'skills' defined in skill needs forecasting approaches in your country?**

In Estonian skill needs forecasting model 'skills' are defined as 'occupational skills' (based on ISCO broad groups) by business activity (based on NACE). As additional background information existing structure of employment by graduated field of education is also included.

**Question 2: Which main method is currently used for mid/long-term forecasting of skill needs at macroeconomic level in your country?**

Estonian skill needs forecasting is done in several steps.

First, macro modelling is carried out which produces overall macroeconomic trends, including employment expansion by nine broad economic sectors.

These general forecasts are taken as a basis for more disaggregated forecasts which finally give results for 35 business activities. More detailed analysis is done by sector analysts who take a closer look at key business activities. Methods used vary depending on sector, but in general they consider demand side and productivity developments. Currently, 24 activities are properly covered from a total of 35 for which the forecast is produced by five sector analysts. Uncovered are mainly very small and public sector activities.

Detailed analysis includes forecasting occupational structure in each economic activity covered. The forecast of occupational structure mainly grounds on recent trends and on feedback and expert opinions of different business associations.

All the above gives the forecast of employment (expansion) by business activity and occupation.

In addition to expansion demand, replacement demand is analysed in the recent forecast paper. This is based on employed persons' distribution by age groups across each business activity. At this point of time same retirement age and mortality rates are assumed for all business activities.

As a third major component, possible intersectoral movements are analysed. Again it is a new component and currently it is a simple scenario on how employees might change their field of activity based on recent trends and on relative demand for new employment in different sectors.

All these three components – news jobs creation, natural wastage and intersectoral movement – form the labour demand for 35 business activities.

**Question 3: Which methods/models are used for the input information on macroeconomic forecasting and (sectoral) employment projections?**

The macro modelling is done by Hermin model adapted to Estonian economy. Currently it is a nine-sector model but there are plans for further aggregations.

**Question 4: Does the skill needs forecasting method only include forecasts of total demand or also expansion demand and replacement demand?**

The forecasting method includes both expansion demand (new jobs creation) and replacement demand (due to mortality and retirement).

**Question 5: Does the method consider the supply side, and possibly interactions between supply and demand?**

The supply side only is considered at very general level in the macro model (through wage formation due to unemployment).

**Question 6: Does the approach also consider (exogenous) factors such as impact of technologies, work organisation, socioeconomic conditions, globalisation/relocation of jobs, etc.?**

Exogenous factors enter the forecast in expert opinions (specific businesses associations' opinions) through calibration of the macro model and are also used for forecasting occupational structure. Exogenous factors such as foreign demand (main trading partners' development) is also considered in the macro model.

**Question 7: Which classifications are in use at different stages of forecasting?**

Employment data are based on LFS aged population 15-74. Employed persons are divided into 35 business activities. Business activities are based on NACE two-digit classification. Employment in each business activity is divided into occupational groups (ISCO broad groups). The initial 10 ISCO groups are aggregated into five broader groups. The main reason is reliability of sample data on such a detailed division.

**Question 8: Data sources and quality**

**(a) Which data and data sources are used at different stages of forecasting?**
**(b) Please indicate the quality of data input.**
**(c) Please mention the minimum length of time series required where applicable.**
**(d) Please - in sample surveys - specify the sample, its representativeness, and the regularity/frequency of the survey.**
**(e) Where data come from the national census, please indicate its frequency and possible combination with other data sources.**
**(f) How do you organise access to these data?**

Macro model uses national accounting data with the exception of labour data. The main data source for labour is Estonian Statistical Office's LFS. For possible intersectoral movement the Estonian Tax and Customs Board data for the whole population of taxpayers is used (history of employees' change of field of activity).

LFS has gone through several methodological changes but from 2001 onwards it has remained mostly unchanged. Considering the sample size and the level of detail used in the forecast, it is appropriate to use three-year (moving) average data.

The macro model currently uses time series from 1997 to the most recent available.

The target population of the LFS contains all working-age (15-74) residents of Estonia. Survey is based on households, where all 15-74 year old household members are included in

the initial sample. LFS is carried out quarterly. Each sampled household is interviewed four times: during two consecutive quarters and after a two-quarter period it is again interviewed twice in the corresponding period of the following year. LFS sample is approximately 15 thousand a year which account roughly 1.4 % of working age (15-74) population.

Census data are used by Statistical Office in the LFS to expand the sample data to the population (calibration of gender, five-year age groups and the place of residence). The last census survey was in 2000 and it is adjusted annually in accordance with registered demographic events.

Most data are publicly available free of charge from the Statistical Office's web page. For more detailed analyses (cross section data) research institutes and ministries can use source (primary) survey data.

**Question 9: What is the output of the forecast?**

*Business activities and related NACE codes*

| **Business activities** | **NACE code** |
|---|---|
| Agriculture, hunting and forestry | 1-2 |
| • agriculture, hunting and related service activities | 1 |
| • forestry, logging and related service activities | 2 |
| Fishing | 5 |
| Mining and quarrying | 10-14 |
| Manufacturing | 15-37 |
| • manufacture of food products, beverages and tobacco | 15-16 |
| • manufacture of textiles | 17 |
| • manufacture of wearing apparel; dressing and dyeing of fur | 18 |
| • manufacture of leather and leather products | 19 |
| • manufacture of wood and wood products | 20 |
| • manufacture of pulp, paper and paper products | 21 |
| • publishing and printing | 22 |
| • manufacture of coke, refined petroleum products, chemicals and chemical products | 23-24 |
| • manufacture of rubber and plastic products | 25 |
| • manufacture of other non-metallic mineral products | 26 |
| • manufacture of basic metals and fabricated metal products | 27-28 |
| • manufacture of machinery and equipment n.e.c. | 29 |
| • manufacture of electrical and optical equipment | 30-33 |
| • manufacture of transport equipment | 34-35 |
| • manufacture of furniture | 361 |
| • manufacturing n.e.c. | 36-37 w/o 361 |
| Electricity, gas and water supply | 40-41 |
| Construction | 45 |
| Wholesale and retail trade; repair of motor vehicles, etc. | 50-52 |
| • sale, repair of motor vehicles; retail sale of automotive fuel | 50 |
| • wholesale trade and commission trade | 51 |
| • retail trade, excl motor vehicles; repair of household goods | 52 |
| Hotels and restaurants | 55 |
| Transport, storage and communication | 60-64 |
| • transport and supporting transport activities | 60-63 |
| • post and telecommunications | 64 |
| Financial intermediation | 65-67 |
| Real estate and renting activities | 70 |
| Other business activities | 71-74 |
| Public administration and defence; compulsory social security | 75 |
| Education | 80 |
| Health and social work | 85 |
| Other economic activities | 90-99 |

The macro model forecast produces nine-sector employment (combined from two-digit NACE activities).

Further steps (and final output) operate with 35 business activities (based on two-digit NACE). See the following table.

For each business activity there are forecasts for occupational structure (based on broad ISCO groups). Due to relatively high level of detail and, therefore, data reliability, occupations are further aggregated into five broader groups as follows:

| | | | |
|---|---|---|---|
| Manager | = ISCO group 1 | = | legislators, senior officials and managers |
| Professionals | = ISCO group 2-3 | = | professionals; technicians and associate professionals |
| Service workers | = ISCO group 4-5 | = | clerks; service workers and shop and market sales workers |
| Craft workers | = ISCO group 6-8 | = | skilled agricultural and fishery workers; craft and related trades workers; plant and machine operators and assemblers |
| Elementary occupations | = ISCO group 9 | = | elementary occupations |

Natural wastage is calculated for each business activity on based on their existing employment distribution by five-year age groups.

Possible (net) flows between sectors are also included in the forecast for each business activity.

The last forecast also included employed persons' graduated field of education (based on two-digit ISCED 97) for each business activity.

The final result gives additional employment need by business activity differentiated by new jobs creation, natural wastage and net intersectoral movement.

**Question 10: What is the period of the forecast?**

The forecast published in September 2005 is made until 2011. To lessen fluctuation due to sampling errors the base year for calculation of employment needs is taken as an average of 2002-04 data. Therefore, it could be considered an eight-year projection.

**Question 11: How often is the forecast repeated?**

The forecast is updated annually, while the macro model is revised every two years.

**Question 12: Are there procedures for the *ex post* evaluation of the quality of results of the forecast? How do you assess the quality (accuracy, reliability, robustness) of the output?**

While the skill needs forecasting approach is its very early development phase, there are no consistent and specified evaluation procedures yet.

**Question 13: What is the use/target group of the forecast?**

The main user of the forecast is Ministry of Education and Science who uses it as input for designing (vocational) educational needs. The forecast paper also includes short descriptions of key sectors' recent development to be more attractive and usable for other interest groups – for example counselling and guidance.

**Question 14: Who does the forecast?**

The forecast is done by Ministry of Economic Affairs and Communications and specifically by its Economic Development Department's analyses division. Currently there are five analysts who give their input to the forecast.

**Question 15: Who pays for the forecasting work and the necessary data?**

The forecasting work is complementary to everyday work for sectoral analysts, so there is no extra fee for that. The data used are free of charge.

**Question 16: What are your ideas for establishing a forecasting approach at European level? How should this activity be organised and cooperation arranged, who should be involved, should there be a platform (e.g. at Cedefop) for cooperation?**

Now as there are and will be more freedom in labour movement it is especially important to analyse possible movements and impacts in different countries. Therefore, it is essential to know relative scarcity and demand of specific type of labour in neighbouring countries. Important first step towards this would be making different countries' skill needs forecasts/methodologies available (one of the results of this workshop). Then it is easier to address further questions.

# Finland

*Pekka Tiainen, Ministry of Labour* ([10])

**Question 1: How are 'skills' defined in skill needs forecasting approaches in your country?**

Skills refer to both occupation and education.

**Question 2: Which main method is currently used for mid/long-term forecasting of skill needs at macroeconomic level in your country?**

Finland has two interacting models:

(a) LTM
The long-term labour force model of Finland (LTM), developed at the Ministry of Labour by Pekka Tiainen, has been in use since 1990. Model contains the demand for labour services and the supply of labour services. The supply side includes seven data sets: the population, persons in retirement, persons in education, household domestic workers and other persons not in the labour force, persons at work part-time, labour market participation rates and working time. The demand side includes two data sets: production and the employed by industry. There is a satellite model, regional LTM, which is used for regionalisation of the result benefiting regional level comments.

(b) Mitenna ([11])
The method applied in National Board of Education forecasting is an application of what is known as the manpower requirement method and called Mitenna. In Finland, the manpower requirement method was first used as a tool for planning education and training at the end of the 1960s. The Planning Secretariat that operated under the auspices of the Ministry of Education developed the method further and used it to prepare several forecasts for demand for educated labour. In the National Board of Education project, this method has been developed further by adding new parts and by making the processing of background material used in the model more precise. The impacts of the unemployed labour force and occupational transitions, for example, were considered more precisely than before. The method uses extensive statistics and calculations of future demand for educated labour. For this purpose, a Windows-based program was developed to perform the required calculations.

Employment results of the former are transferred to the latter. The model's structures and use are described below to the extent that they are relevant to this work.

Regional level calculations are made in cooperation with the Ministry of Interior Affairs.

**Question 3: Which methods/models are used for the input information on macroeconomic forecasting and (sectoral) employment projections?**

Global and macroeconomic development is analysed as well as development of investment, consumption, export and import. OECD, World Bank, IMF and figures from different countries are used when export development is examined. This kind of analysis is used in GDP growth

([10]) This paper is based on a presentation at Cedefop meeting in Cyprus but also refers to a peer review meeting on 3 and 4 June 2006 on Finnish anticipation method.

([11]) More information about Mitenna is available from Internet: www.oph.fi and www.edu.fi [cited 25.8.2006].

alternatives. Second, GDP growth is aggregated from industrial level figures also using labour supply and productivity limitations and alternatives. Third, historical time series analyses are used especially for getting an idea of long-term developments. The future is calculated by using historical developments (trends, changes in trends and business cycles) and then by exploring how new factors have changed the behaviour and development of the economy. Potential risks (imbalances and for instance technology risks in positive or negative sense) are analysed and sensitivity calculations are used. Statistical consistency of figures is required (in national accounts sense).

**Question 4: Does the skill needs forecasting method only include forecasts of total demand or also expansion demand and replacement demand?**

In LTM expansion and replacement demand of labour are included; the latter includes replacement because of retirement and death.

New jobs are increasing employment. Part of them are substituting job losses. A part of job losses happen when people retire and a part when older people lose or leave their jobs.

The LTM uses national accounts statistics in forecasting economic development. The data sets are production at fixed prices, productivity, hours worked and number of employed, all by industry. Balancing demand and supply of labour, adjustment is needed between employment figures drawn from national account statistics and labour force survey.

The development of production and productivity is projected first in the model, using the latest forecasts of economic activity.

Production divided by productivity of labour by branch of economic activity yields the hours worked by branch of economic activity; summing up these hours gives us the aggregate hours worked. Restrictions might emerge from the supply side: if production grows too fast in relation to the available supply of working hours, it forces a decline, while in the opposite case it allows stronger growth in production. For instance, the trend correction might be used for the year 2030, the aggregate hours worked are replaced with the number of working hours available.

The employment data set of the demand side contains working time, hours worked and the employed by branch of economic activity. Working times vary by branch of economic activity. Technically, we have set the working times for all branches of economic activity at the same level for the year 2030 (in national account data sets), and the working time by branch of economic activity approaches this level using the coefficient of steady change computed for each branch of economic activity.

At demand side, variables are at industrial level for period 1960-2030 at yearly bases and are related so that:

Productivity of labour (history) = production: hours worked

Hours worked (future development) = production: productivity of labour

In the Mitenna model there is also demand side and it is described after LTMs supply side description.

| Question 5: | Does the method consider the supply side, and possibly interactions between supply and demand? |
|---|---|

## LTM

*Population data*

Labour calculations are based on the population forecasts by Statistics Finland. The population forecasts can be modified by adjusting assumptions about immigration, birth rate and mortality, which allows calculations to be made on an alternate basis. The forecasts of population include consistent data at regional and municipal levels.

*Participation rates (activity rates)*

The future supply of labour is the outcome of predicted labour force participation rates and populations forecasts by five-year age groups for men and women, covering the population of 15 to 74 years. Statistics and definitions are based on the LFS (employed, unemployed, people not in the labour force).

Several aspects and sources are evaluated and used for predicting the future labour force participation rates:

(a) the history of the population cohort with its educational, fertility and health characteristics. The baby-boom cohorts (born in 1946-50) are special in the Finnish population because of their size and 'avant-garde' societal behaviour. The life patterns regarding working life are different for cohorts before and after them. For instance, the baby boom cohorts have been better educated than earlier cohorts and consequently their activity rates have been at a higher level (LFS time series, but there is a break in time series in 1989);

(b) the share of people in training and education. Plans and targets are considered (plans, targets and estimates carried out by the Ministry of Education and the Board of Education);

(c) the share of people performing domestic work: considering the impacts of birth rate, child and family allowances, conciliation of work and family life and care for dependant people (expected share of parents on parental leave and on other kind of family policy leaves and share of people caring elderly (dependant adults); calculations by the Ministry of Social Affairs and Health);

(d) the share of disabled people and pensioners (the calculations of the development of pensioners by the Ministry of Social affairs and Health, the Social Insurance Institution of Finland and the Finnish Centre for Pensions).

In calculations, variables are on yearly bases for the period 1960-2030 and are related so that:

$$\text{Labour force participation rate} = \frac{\text{Labour force}}{\text{Working-age population}} * 100$$

$$= \frac{\text{Population} - \text{persons not in the labour force}}{\text{Working-age population}} * 100$$

$$= 100 - \text{working-age population in retirement} + \text{student populations} + \text{household domestic workers and persons otherwise not in the labour force}$$

Additional labour force participation rates include standard rates and labour force participation rates from the previous peak of business cycle and previous modelling. These labour force participation rates, calculated on a basis other than the number of persons not in the labour

force, are needed for the evaluation and control of output, because calculations concerning persons not in the labour force have been made separately from all others and the output thus has to be made compatible with the whole.

*Working time*
Working hours and the share of part-time work has to be considered, both at the supply and demand sides of labour. Demand and supply are changed to input in working hours by using working time. Interaction between supply and demand achieves imbalance and demand influences on supply (total and differently by age categories and supply on demand). Influences differ during business cycle and at long term.

The working time data set first shows general working time factors that concern all age groups. Age-group specific factors are presented separately by five-year age groups for men and women. The figures are given as working days per employed person by five-year age groups. Working days are then multiplied by projections of the number of people employed, yielding the aggregate number of working days. Multiplied by the number of working hours per working day, this yields the aggregate hours worked. The number of people employed is obtained here by taking, as the basic data, the labour force under conditions approaching low unemployment. The unemployment rate verges on full employment, and employment accordingly increases. This method is aimed to give us the number of working hours available. The aggregate supply of working hours is copied into the production data set of the demand side, after adjusting the level to agree with the levels from the national accounts.

*Interaction of demand and supply*
The level of demand for labour affects the supply: the higher the demand, the higher the labour force participation rates. At the moment we do not have age- and gender-specific elasticities calculated between the demand and supply for labour in the model. Instead, we consider the incentive and discourage effects in the level of final outcome of the supply of labour (in some earlier projects we had age and gender specific elasticities between the supply and demand of labour and we were able to calculate, 'calibrate', the labour supply for a certain level of demand, i.e. a certain level of unemployment. In further calculations the supply of labour was adjusted to demand using the relationship.).

The numbers of people employed, in line with the national accounts, are copied to the data set and adjusted to agree with the LFS. We do adjustments with the demand and supply of labour: as the unemployment decreases, an effect will be growth in supply of labour force participation.

**Mitenna**

In the Mitenna model skills of working age population and educational needs are calculated. The model uses the manpower requirement method which is divided into two sections. The first focuses on the needs of working life, anticipating demand for new labour. This covers the amount of labour required by economic life and the types of education it will need the labour force to have in the anticipation period. The calculation consists of forecasts of changes in demand for labour and estimates of labour wastage. The second section of the method concerns the supply of labour. The majority of the supply of new labour comes from new young age groups. In addition, the unemployed labour force will bring its own addition to the supply. Occupational transitions in working life will have an influence on the occupational structure and will increase or decrease labour supply in each occupational group according to whether

the occupational group concerned is a net winner or loser after the transitions. In addition, the supply of labour will be influenced by labour force participation rates, i.e. the proportion of the working-age population included in the labour force.

*Educational needs of working life*

The calculation of educational needs in working life is presented in phases in Figure 2 (in annex). The starting point is the forecast of demand for labour by industry which is taken from the LTM. This forecast is worked out from the production forecasts describing the overall development of the national economy, which have allowed for the joint impact of the forecast of added value in production and development in the productivity of labour. These in turn are based on a set of economic change factors.

The next step is to anticipate the future occupational structure in each industry. This is accomplished by examining the present occupational structure and changes that have previously occurred in the structure and by anticipating future developments. In addition, international and other comparisons and forecasts of occupational structure are also utilised, together with research information and the views on changes expressed by experts in different fields. The difference between the anticipated and present occupational structure indicates the change in the occupational structure during the forecasting period.

Along with changes in the occupational structure, natural wastage of labour is investigated. This means the proportion of those in an occupational group, who will permanently leave the labour force due to retirement (through old age), disability or death. Consequently, the wastage data consist of age-related wastage and other permanent wastage.

Adding up the change in the occupational structure and natural wastage results in the total demand for new labour during the forecasting period. This means the volumes of new labour by occupational group that working life is estimated to need during the forecasting period. The significance of labour wastage is dominant in this respect, accounting for about 70–90 % of the calculated total demand.

Forecasts by occupational group and data on changes concerning working life are converted into forecasting data conforming with the classification of fields of study by using a correspondence key to match occupational groups and education, which was specifically constructed for that purpose. The correspondence key is constructed by assessing the different types of education for each occupational group that make it possible to achieve the vocational competence necessary in this particular occupational group. The background data used to create the key is obtained by cross-tabulating occupational groups and types of education.

To obtain a sufficient amount of appropriately educated labour for economic life, the intake to education should exceed the demand for new labour. Different types of education vary considerably in terms of popularity. Not all fields are able to attract as many students as their annual intake can accommodate. Conversely, there are other fields where demand exceeds supply. Some students interrupt their studies, whereas others complete several educational qualifications. Not all people who have completed a qualification will move into working life straight after they leave school. The proportion of people who have started a study programme in relation to the number of student places available in the intake is known as the occupancy rate. The completion rate of education in turn means how many of those who have started a programme will complete the qualification. Multiple education means completing more than one educational qualification. When these factors – occupancy rates, completion rates, rates of

multiple education and labour force participation rates – are taken into account, this will result in the intake needs in education from the perspective of working life. These are called the educational needs of working life.

*Intake needs*
The objective of estimating the intake needs of education for young people is to guarantee future young age groups a student place after comprehensive school or general upper secondary school. The calculations are based on the age-group forecasts of 16-19 years old.

The intake needs exceed the size of the age group to be educated, since some new student places will remain unoccupied, some will be wasted in interruptions and some others will fall within multiple educations. Bearing these factors in mind, the result is the calculated need for intake in youth-level education, which will be sufficient for providing the entire age group with vocational education.

The intake needs of adult education and training are estimated separately for the employed and the unemployed labour force. Education and training leading to initial qualifications are considered as constituting an educational need. The adult education needs of both the employed and the unemployed labour force are anticipated in the occupational field in which a person operates or operated before being unemployed and, in some other occupational field, which means a change of occupations.

The adult education needs by occupational group are converted into educational needs by field of study and level of education by using the correspondence key for occupational groups and education. The total need for adult education and training by field and level is worked out by adding up the educational needs of the employed and the unemployed labour force.

*Labour supply of unemployed people*
The labour supply of unemployed people taken into account in the calculations comprises the number of unemployed people in the base year, after the figure for natural wastage has been subtracted (Figure 3 in annex). In addition, the calculations of labour supply also allow for the remaining working life of unemployed people. According to studies conducted in Finland, it is unlikely that unemployed people aged over 55 will return to work, which is why this group has not been included as part of the reserve labour force in the anticipation.

*Coordinating the educational needs of working life and the calculated intake needs*
The manpower requirement method described above is used to estimate the assumed needs of working life. This takes into account the amount of labour required by working life and the types of education the labour force will need during the forecasting period (total demand for new labour) and the number of new student places in different fields and levels which should be offered to fulfil these needs (educational needs of working life).

The next step is to work out the intake needs for youth-level vocational education on the basis of the size forecast of young age groups and the intake needs of adult education and training based on the number of vocationally uneducated people and occupational transitions. The educational needs of working life and the intake needs have been derived from different sources. In the next stage, these results must be coordinated.

In terms of supply of vocationally educated labour, youth-level education and adult education and training are very different. New labour mainly comes from young age groups, who enter working life. Conversely, adult education and training do not necessarily produce any new

labour; instead, these will primarily change the occupational structure and competence of the existing labour force. This difference must also be taken into account in calculations.

New student places in adult education and training are needed both for those who will stay in their own occupational field and for those who will change occupation. However, only the latter (occupational transitions) will also have an impact on the occupational structure of the labour force and, subsequently, on the occupational and educational structure of the demand for new labour.

The occupational transitions in the labour force do not alter the total volume of labour. The fields into which people move will grow, whereas those from which people move will be reduced correspondingly. The positive and negative changes by occupational group due to occupational transitions are converted, by means of the correspondence key for occupations and education, into changes by field of study and level of education. These changes are taken into account in the structure of the previously calculated educational needs of working life. In addition, the impact of the labour supply caused by the unemployed labour force on the educational needs of working life will also be taken into account. This makes it possible to calculate the new volume and structure of the educational needs of working life.

The total number of new student places in youth-level education is distributed to the different fields of study and levels of education in proportion to this new structure of educational needs of working life.

Consequently, adult education and training and youth-level education have been methodically organised such that the impact of adult education and training on fulfilling the educational needs of working life will be estimated first and, only after this has taken place, is the structural distribution of new youth-level student places estimated. If the volume or structure of intake in adult education and training is altered, this will also automatically have an influence on the structure of intake in youth-level vocational education.

Consistency of supply of labour in Mitenna and in LTM is checked. Calculations are regionalised so that employment by industries from regional LTM is transferred to Mitenna model and occupational calculations are made by using this employment data.

**Question 6: Does the approach also consider (exogenous) factors such as impact of technologies, work organisation, socioeconomic conditions, globalisation/relocation of jobs, etc.?**

Exogenous factors are analysed. World economy development is exogenous from the point of view of a small country. Other variables such as population and migration are first exogenous and then endogenised so that changes in demand of labour have influence on labour demand. The calculations are part of a framework which includes broader issues qualitatively or quantitatively to tighten or precise more the connection to model calculations.

**Question 7: Which classifications are in use at different stages of forecasting?**

Mainly standard statistical office classifications are used because of efficiency in use of statistics and because of needs for comparisons and use of results in different contexts. Different classifications are used for special purposes.

**Question 8: Data sources and quality**

**(a) Which data and data sources are used at different stages of forecasting?**
**(b) Please indicate the quality of data input.**
**(c) Please mention the minimum length of time series required where applicable.**
**(d) Please – in sample surveys – specify the sample, its representativeness, and the regularity/ frequency of the survey.**
**(e) Where data come from the national census, please indicate its frequency and possible combination with other data sources.**
**(f) How do you organise access to these data?**

Data come mainly from official statistics (national accounts, population census, LFS) and special PTDATA which include historical data concerning national accounts, labour-market developments and population integrated to calculations for the future. In Mitenna occupational structure since 1970 is used. Other sources are also used.

Quality of data is satisfactory but there are some problematic areas where data are not sufficient: for instance separation of new jobs and lost jobs. Change in occupational structure in the longer term needs more analysis. Changes in statistics in general are a problem in time series.

LFS is applied as a sample survey and the data are used from 1989 (longer term also but there is a break in time series). There is longer history in national accounts and population statistics. Population statistics are necessary part of supply side analyses.

Official statistics are easily in use but there are also problems. Not all historical data are in digital form and therefore, for example for population census statistics, it takes time before they can be used.

**Question 9: What is the output of the forecast?**

The target is to analyse sources of growth, employment and labour force/occupational projections including the identification of needs for education and training.

The main point is the developments and interaction between demand (growth, productivity, labour demand developments) and supply side (population, labour force participation rate, labour force, unemployment developments).

**Question 10: What is the period of the forecast?**

Former forecasts were to the year 2020, the next one (in 2006) is planned to be to 2025, calculations to 2030 and also to longer term.

In occupational developments former forecasts were to the year 2015, next will be to the year 2020.

**Question 11: How often is the forecast repeated?**

Broader calculations are done in every four-year period (now labour force 2025 working group and education planning 2012 – in latter needs for new incomers to education in the period 2008-12). Intermediate calculations are made a year before main reports and other calculations yearly.

**Question 12:** **Are there procedures for the *ex post* evaluation of the quality of results of the forecast? How do you assess the quality (accuracy, reliability, robustness) of the output?**

For an intermediate report there are *ex post* evaluations.

**Question 13:** **What is the use/target group of the forecast?**

Government and ministerial level, regional level and research institutes, but also international level; employers and job-seekers.

**Question 14:** **Who does the forecast?**

Working group network.

**Question 15:** **Who pays for the forecasting work and the necessary data?**

Mainly central government.

**Question 16:** **What are your ideas for establishing a forecasting approach at European level? How should this activity be organised and cooperation arranged, who should be involved, should there be a platform (e.g. at Cedefop) for cooperation?**

Alternatives are (presentation in the workshop):

(a) a predominantly European approach, i.e. use standardised European (Eurostat) data and forecast 'centrally' with the help of an agreed method(s);

(b) a predominantly Member State approach, i.e. collect forecast results from Member States in the agreed structure for aggregation and comparison at European level;

(c) a combined approach, i.e. use European data as much as possible and fill the gaps with the help of Member States.

Nowadays the second approach is most realistic. Central approach can be used in some calculations and comparisons but needs of national labour markets are so different that it is better to develop approaches, classifications, networks and some statistics for all Member States. European level statistics are needed because of better labour-market functioning (international recruitment, reallocation of business activities to countries with underutilised human capital resources) and for benchmarking.

Harmonisation is important for international classifications (NACE, ISCO, ISCED), data sources (Eurostat, OECD) and macroeconomic forecasts (European Commission, OECD, IMF, etc.) used.

# Annex

*Figure 1: Calculation method of the long-term labour force model in Finland*

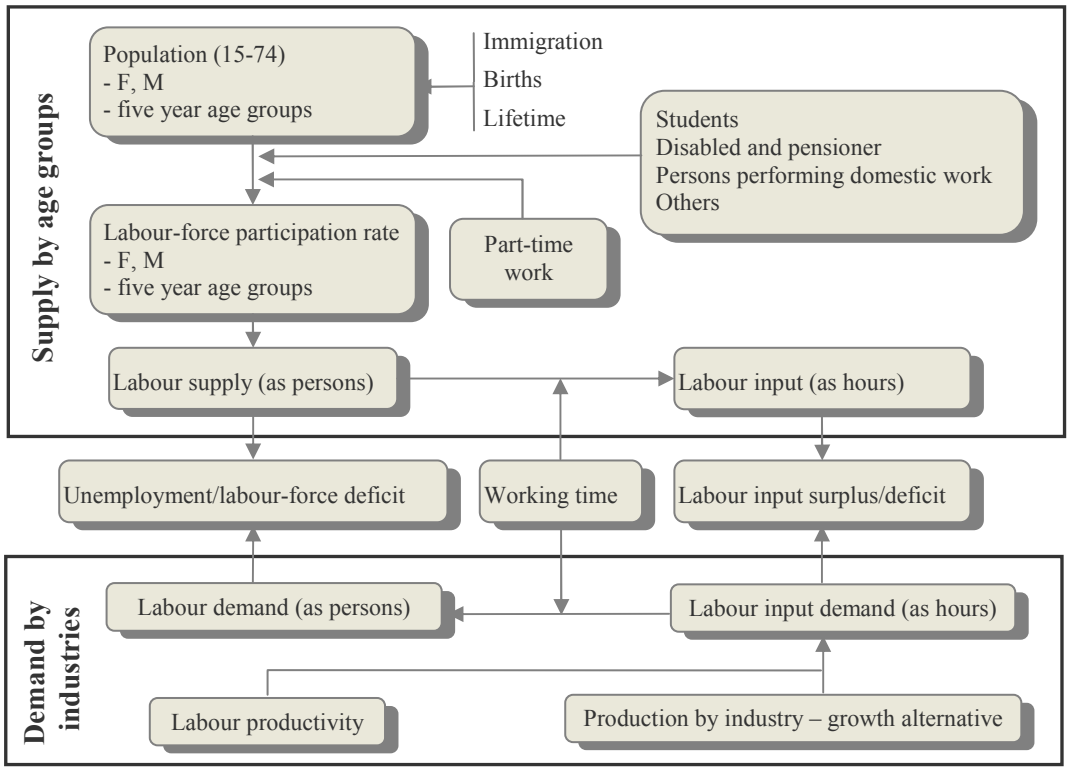



*Figure 2: Anticipation process for quantitative needs in vocational education and training. Mitenna.*

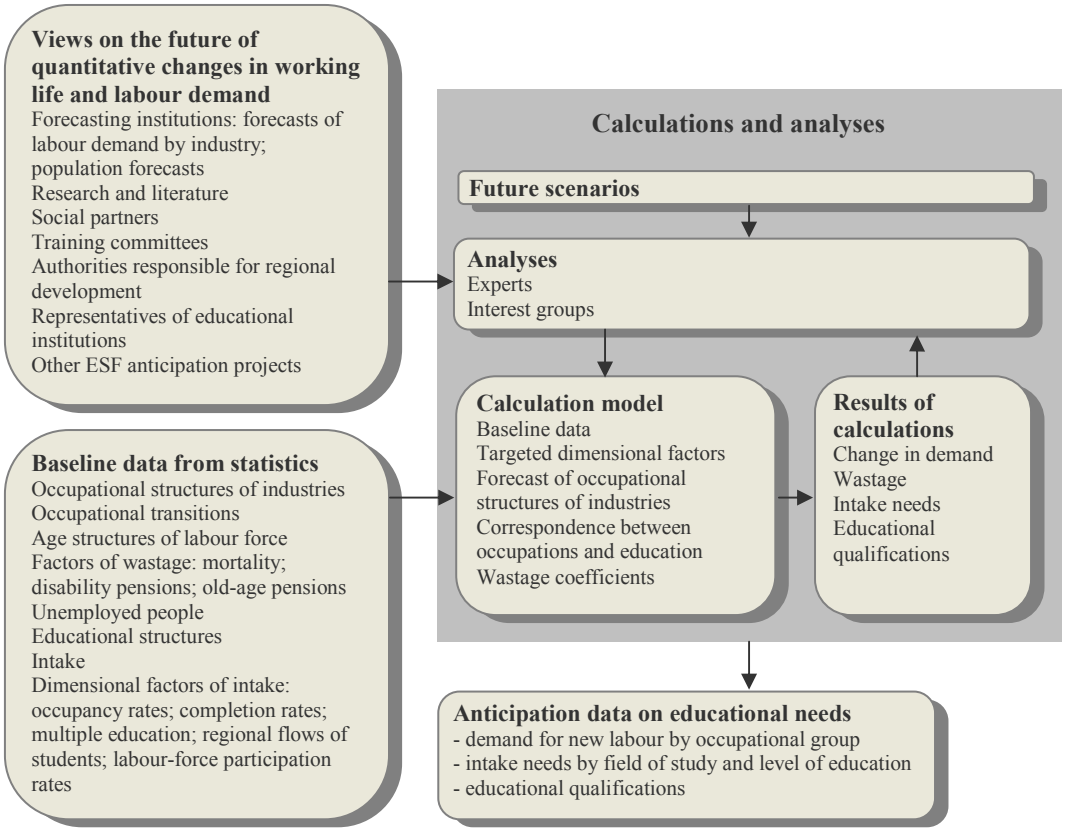
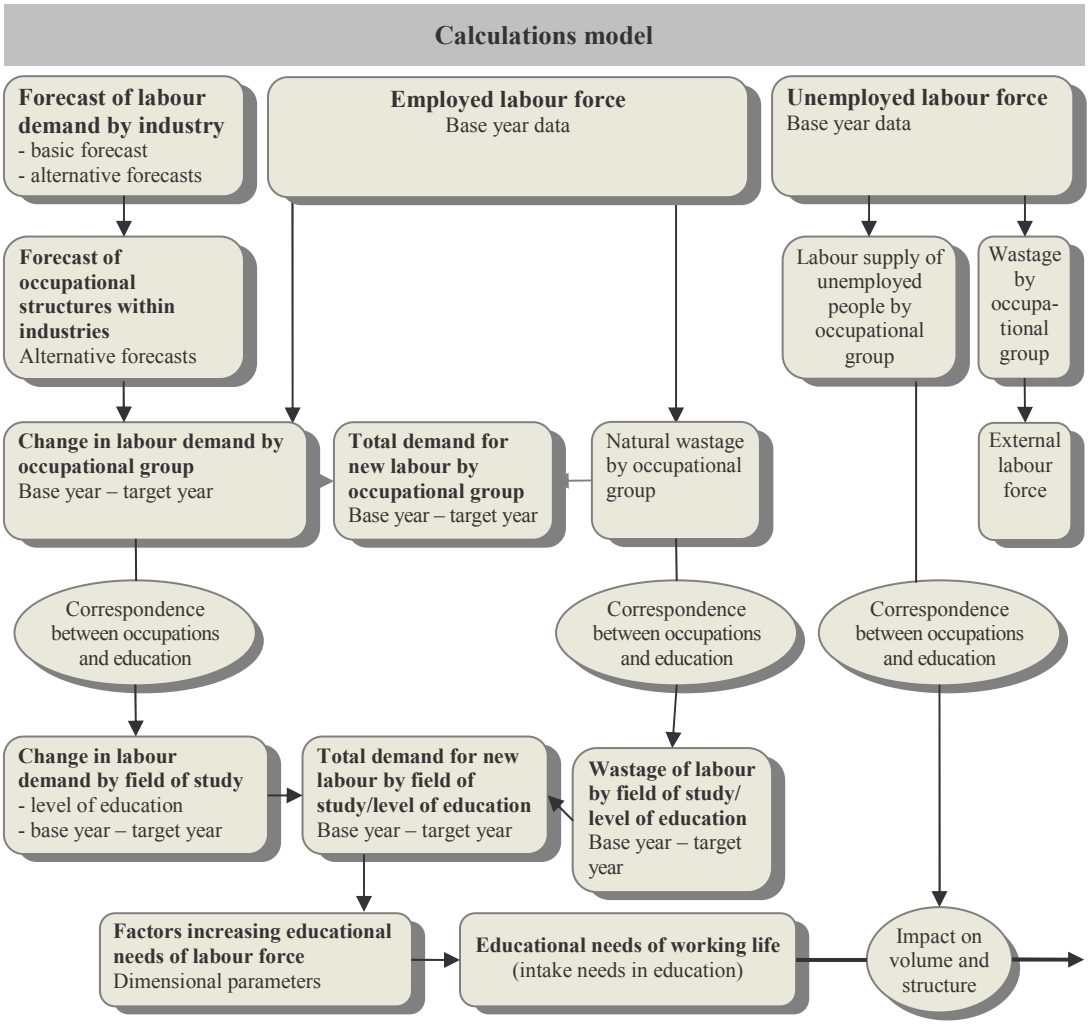


*Figure 3: Educational needs of working life*

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# France

*Claude Sauvageot, Ministry of Education*
*Marc-Antoine Estrade, Planning Office*

In France there are two main forecasting approaches developed by two different institutions:

(a) French Planning Office ([12]) – *Commissariat général du Plan* and French Ministry of Labour: Forward study on skills and qualifications (*Prospective des métiers et qualifications* – PMQ)

(b) French Ministry of Education (*Ministère de l´éducation nationale* – MEN)

**Question 1: How are 'skills' defined in skill needs forecasting approaches in your country?**

[PMQ] In this project run by the French Planning Office and the Ministry of Labour, skills refer to 'occupational skills', based on a national occupational classification. The classification is named *familles professionnelles* (FAP) and describes the whole workforce in 84 occupations. This classification results from the confrontation of two other much more detailed occupational classifications: *Répertoire opérationnel des métiers et des emplois* (ROME) which is the classification used by the public employment services for managing jobs and unemployed, and *Professions et catégories socioprofessionnelles* (PCS) which is used by statistical bodies in surveys, like LFS. Both ROME and PCS can be, even roughly, transcoded into ISCO, but FAP cannot.

PCS is largely based on the classifications used by sectoral collective agreement to describe jobs and wages.

Main interests in using these classifications:

(a) widely used for years;

(b) can be used to calculate short-term shortages;

(c) understandable for sectoral actors.

[MEN] In the project of the French Ministry of Education, we forecast the needs of school-leavers recruitment from the economic demand point of view. We use two classifications. One on level of education (it is not ISCED but there is a link between our classification and ISCED). As our colleagues in the Planning Office, we use PCS and we can roughly transcode them in ISCO, but these two classifications are not fully compatible especially because we use an aggregated level for PCS. To compare PMQ and MEN studies/work we allocate needs by professional domain (linked with FAP). At this level there is no transcodification with ISCO.

**Question 2: Which main method is currently used for mid/long-term forecasting of skill needs at macroeconomic level in your country?**

[PMQ] Two different stages are projections of replacement needs of occupations and qualitative confrontations with sectoral studies.

Three models have been developed:

(a) macroeconomic projections, broken down into sectoral projections;

(b) labour demand projections by occupations (see methodological annex);

(c) projections of retirement departures by occupations.

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([12]) The Planning Office was closed down in March 2006 and was replaced by the Strategic Analysis Centre (*Centre d´Analyse Stratégique*). The PMQ project continues within the new Centre.

[MEN] We use three different models

(a) macroeconomic projections, broken down into sectoral projections (developed by BIPE – *Bureau d'informations et de prévisions économiques* – which is different from the model used by the Planning Office) with different assumptions about GDP growth;

(b) labour demand by PCS based on sectoral macroeconomic projections – retirements – professional mobility;

(c) labour demand for school-leavers by PCS.

**Question 3: Which methods/models are used for the input information on macroeconomic forecasting and (sectoral) employment projections?**

[PMQ] For the 2015 projections, a macro model based on potential growth is used. We choose several long-term unemployment rate targets, combined with activity rates projections.

The sectoral breakdown is obtained by forecasting sectoral value-added and labour productivity. These sectoral forecasts are then used to forecast occupations.

[MEN] We use two models developed by BIPE: Micado (Model of interpretation of growth and anticipation of demand and supply) and DIVA (Intersectoral dynamics to 20 years).

In addition, we use another BIPE model (Calife) to forecast skill composition by sector and by occupational category (PCS).

**Question 4: Does the skill needs forecasting method only include forecasts of total demand or also expansion demand and replacement demand?**

[PMQ] We developed a micro simulation model to forecast retirements by occupations, considering various factors: age, gender, schooling, work hardness of jobs, administrative rules to retire, etc.

[MEN] We include both expansion demand and replacement demand.

**Question 5: Does the method consider the supply side, and possibly interactions between supply and demand?**

[PMQ] There is no model for the supply side. It is analysed in the qualitative stage, by analysing sectoral recruitment policies and the way they may change in the future. For each occupation, we have several indicators concerning the type of labour markets (internal, professional, etc.), type of recruitment (mainly young people leaving school or experienced workers), size of firms. We also consider actual short-term shortages and number of unemployed, possible mismatches, and so on.

[MEN] We consider the supply side, i.e. projection of school-leavers by level of education. Interaction is taken into account when we hypothesise in our different models.

By doing that we can point out some shortages at certain levels.

**Question 6: Does the approach also consider (exogenous) factors such as impact of technologies, work organisation, socioeconomic conditions, globalisation/relocation of jobs, etc.?**

[PMQ] In the qualitative stage, all these factors are analysed for each sector. In the future, we will try to modify our labour demand projections model to allow changes in sectoral productivity.

[MEN] Same answer.

**Question 7: Which classifications are in use at different stages of forecasting?**

[PMQ] At sectoral level: specific French sectoral classifications (NES16), widely used for the national accounts. For occupations: FAP (see above).

None of these classifications are compatible with international ones.

[MEN] Same answers as PMQ (but sectoral demand with 36 posts) + education levels (compatible with ISCED) + PCS (only roughly compatible with ISCO).

**Question 8: Data sources and quality**

**(a) Which data and data sources are used at different stages of forecasting?**
**(b) Please indicate the quality of data input.**
**(c) Please mention the minimal length of time series required where applicable.**
**(d) Please – in sample surveys – specify the sample, its representativeness, and the regularity/ frequency of the survey.**
**(e) Where data come from the national census, please indicate its frequency and possible combination with other data sources.**
**(f) How do you organise access to these data?**

The following data and data sources are in use at different stages of forecasting:

(a) macroeconomic forecasts and sectoral employment: national accounts;

(b) occupations and recruitment policies: LFS.

Quality of the sources are excellent.

We have long time series available but we have just changed the methodology and have to adjust.

From 2002, the LFS became continuous and results are released every quarter. The size of the sample is around 220 000 people interviewed each year.

The data are easily accessible through INSEE (national statistical office), which is in charge of both national accounts and LFS.

**Question 9: What is the output of the forecast?**

[PMQ] The main output is the projection of number of jobs opened to recruitment by occupations (80). We do not consider any type of correspondence between occupations and educational level.

[MEN] The main output is the projection of school-leavers recruitment by level of education and by PCS. We can identify shortages at some levels (of course higher levels) but the results are very sensitive to macroeconomic assumptions and for firms' policies on professional mobility.

**Question 10: What is the period of the forecast?**

[PMQ] 10 years. [MEN] Around 10 years.

**Question 11: How often is the forecast repeated?**

[PMQ] The first forecast was carried out in 2002 for 2000-10. The next in December 2005 for 2005-15.

[MEN] Carried out at the ministry's request, in line with economic changes. Forecasts were carried out in 1985, 1988, 1994, 2001, 2003 and a new one is underway.

**Question 12: Are there procedures for the *ex post* evaluation of the quality of results of the forecast? How do you assess the quality (accuracy, reliability, robustness) of the output?**

[PMQ] Evaluation of the previous forecast was mainly on the methodological side, not on the results as the growth hypothesis was totally wrong for the period 2002-05.

[MEN] We usually compare projection results with reality to analyse where the main differences are and to use the comparison to improve our models.

**Question 13: What is the use/target group of the forecast?**

[PMQ] The main objective of these projections is to give a complete picture and common knowledge of what may change in the qualifications and occupational fields along with demographic and economic trends. These projections allow various decisional levels (national, regional and sectoral) to assess their own skill and occupational needs. However these forecasts cannot be used for guidance or policy-making.

[MEN] It is a tool to stimulate thinking at different levels: policy-makers, social partners, researchers. Of course we cannot use them directly. They are neither projections nor previsions.

**Question 14: Who does the forecast?**

[PMQ] The Planning Office with the Ministry of Labour.

[MEN] *Mission éducation, économie, emploi (DEP) de la Direction de l'évaluation et de la prospective du Ministère de l'éducation nationale* [Education, economy and employment group, Directorate for evaluation and forecasting, Ministry for National Education]

**Question 15: Who pays for the forecasting work and the necessary data?**

[PMQ] The State. [MEN] The Ministry of Education.

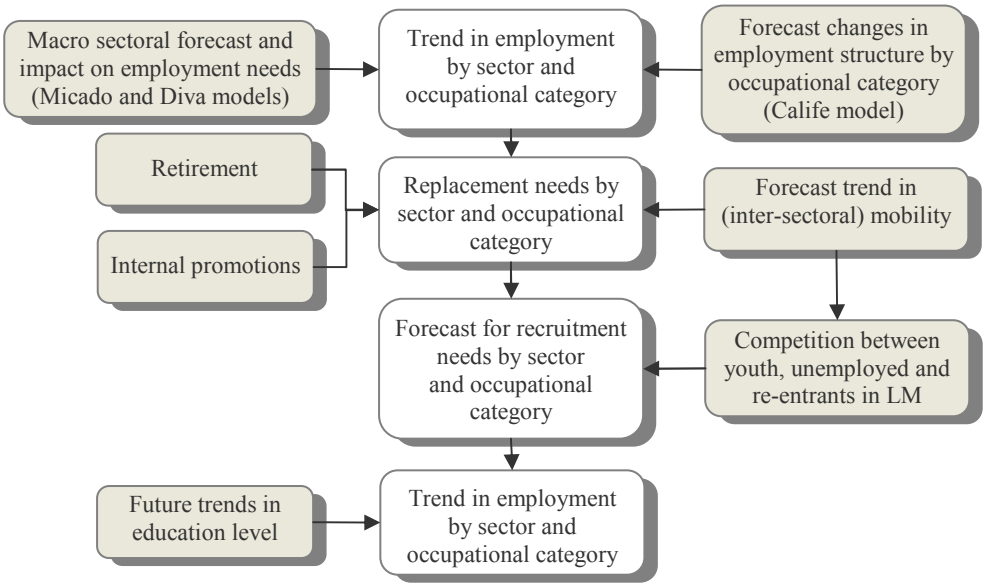
**Question 16: What are your ideas for establishing a forecasting approach at European level? How should this activity be organised and cooperation arranged, who should be involved, should there be a platform (e.g. at Cedefop) for cooperation?**

[PMQ] Main challenges for establishing a forecasting approach at European level are classifications and identification of target groups.

[MEN] Main challenges are to define a common background, to choose a method agreed by all countries, to find common classifications or fully compatible classifications to do the exercise.

# Annex: Methodology and models used by BIPE for the French Ministry of Education

## Methodology at a glance




## Different steps in the forecasting process

Step 1: long term macro and sectoral forecast of the French economy: production, value added, employment
Step 2: forecast changes in the necessary qualification/skills by sector, taking into account technological change and the modernisation of the capital stock
Step 3: forecast exits from the workforce (due to retirement, mobility, other); estimate replacement needs per sector
Step 4: confront the qualification/skills of those at work with the needed qualification/skills; define the recruitment needs by sector/occupational category
Step 5: estimate future recruitment patterns taking into account:
- the number of people who exited the education system, and their qualification level;
- competition for work between those entering the labour market, registered unemployed and formerly discouraged workers who decide to re-enter the labour market.

## The Micado model

(a) Micado = *Modèle d'interprétation de la croissance et d'anticipation de la demande et de l'offre*
(b) macro model used to forecast long term trends in the French economy;
(c) forecasts both long-term demand and long-term supply trends, assumes a constant returns Cobb-Douglas production function;
(d) takes into account capital accumulation and L/K substitution (L=labour; K=capital)
(e) takes into account financing capacity of the economy.

## The Diva model

Diva = *Dynamiques Inter-sectorielles à Vingt Ans*

(a) a long-term, I-O based, sectoral forecast model of the French economy

(b) 36 sectors

(c) four blocks:
- trade with the rest of the world
- domestic demand
- production and imports, incl. inter-links between sectors
- productivity and employment by sector

## The Calife model

CALIFE = Qualification emploi

(a) forecasts employment by sector and occupational category
- forecasts changes in skills over time, taking into account the different generations of equipment and the impact of technological developments on skill levels needed
- takes into account the differences between modernisation investments, and investments in new capacity, on the skills needed
- expert information is taken into account to identify potential breaks from past trends and validate the needed changes in the skill composition

(b) 36 sectors, 16 socio-professional categories

## Forecasting process of the PMQ project

(a) demographic and active population forecasts done by INSEE (French National Statistical Office)

(b) macroeconomic forecast based on a long-term potential growth approach; forecasts of sectoral value added shares

(c) labour demand forecasts by occupation, via a production function equation (one for each occupation) Flip-Fap model, French Ministry of Labour (DARES)

(d) retirement exits from employment by occupation via a micro simulation model: Profilage, French Planning Office
- estimation of recruitment needs by occupation.

# Germany

*Holger Bonin, Institute for the Study of Labor (IZA)*

**Question 1: How are 'skills' defined in skill needs forecasting approaches in your country?**

Skill needs forecasting on behalf of German government authorities focuses on formal qualification levels. Specifically, projections generally distinguish five formal qualification levels: no apprenticeship training, apprenticeship training, vocational/technical school (*Meister/ Techniker/Fachschule*), university of applied sciences (*Fachhochschule*) and university. However, an ongoing forecasting effort attempts at provision of forecasts referring to educational attainment as measured by ISCED, too.

In addition, it is part of the national forecasting programme to disaggregate skills by occupation and by the subject of study of individuals with either kind of university training. However, these disaggregated forecasts only consider the demand side of the labour market.

**Question 2: Which main method is currently used for mid/long-term forecasting of skill needs at macroeconomic level in your country?**

Two separate forecasts based on different techniques are employed. A first forecast predicts the demand for specific skills as reflected by the number of individuals with a given skill who are in full employment. The full employment concept excludes employed individuals on minor employment contracts (*geringfügige Beschäftigung*) or in apprenticeship training. It includes, however, employed individuals in education, provided they do not work on a minor employment contract. The demand-side calculation does not consider unemployed individuals. A second forecast predicts the supply of specific skills measured by the number of individuals with a given skill who participate in the labour market, i.e. who are either employed or in search of a job.

The demand-side projection employs a modified manpower concept. This means there is no explicit macroeconomic model driving the forecast. Instead, the forecast is based on the following empirical relationship, which is estimated on the economy level:

$$\ln(employment) = a + b \ln(population) + \mathrm{c} \ln(GDP)$$

In other words, future growth rates of employment demand are assumed to be equal to the long-term historical average $a$, which reflects productivity growth, corrected for the impact of changes in population size as measured by the estimated elasticity $b$, and the impact of economic growth as measured by elasticity $c$.

Disaggregation of demand by skills follows a top-down approach. In a first step, forecast total labour demand is disaggregated on the basis of trend extrapolations for the shares of workers by economic sector. Further steps extrapolate trends of employment shares by skill level within economic sectors. Extrapolation of employment shares is generally based on linear or quasi-logarithmic trends.

On the supply side, forecasts distinguish between individuals with completed education and individuals not yet or still in the education system. Individuals who have already left the education system are traced through their career to retirement by combining a population

forecast with age-, gender- and qualification-specific participation rates. Thus determined changes in labour supply by skill are considered as replacement demand.

The forecast of qualifications produced by the education system is based on a comprehensive input-output-matrix, which covers school, vocational and academic training starting from entries into primary schools. The parameterisation of the model employs age-specific transition rates between the different types of schooling, which are derived from microdata.

**Question 3: Which methods/models are used for the input information on macroeconomic forecasting and (sectoral) employment projections?**

Skill needs forecasts in Germany do not apply any formal macroeconomic model, either on the aggregate or on the sectoral level. This modelling decision reflects serious doubts about the capacity of any (multi-equation) macroeconomic model or (general equilibrium) growth model to produce reliable long-term forecasts. In fact, adequate parameterisation of such models is extremely difficult. Put differently, acknowledging the statistical uncertainty in empirical parameters produces forecasts with confidence intervals that are considered too large to be informative. Moreover, government contractors perceive macroeconomic models as not sufficiently transparent. They view the simplicity of the approach sketched above as a major advantage.

**Question 4: Does the skill needs forecasting method only include forecasts of total demand or also expansion demand and replacement demand?**

The German forecasting includes a separate forecast of replacement demand based on an analysis of labour supply. On the demand side, it is possible to distinguish between (sector specific) expansion demand associated with economic growth and total demand, which results from the combination of economic and population growth.

**Question 5: Does the method consider the supply side, and possibly interactions between supply and demand?**

In forecasting skill needs by educational attainment, both market sides are considered to be equally important. However, the demand and supply forecasts are performed completely independently, due to the massive empirical difficulties involved in the specification and identification of an interacted model describing supply behaviour as a function of demand conditions (including the possibility of unemployment) and vice versa. Consequently, no attempt is made at computing excess demand or supply in the markets for particular skills, by balancing the outcomes for the two market sides against each other.

**Question 6: Does the approach also consider (exogenous) factors such as impact of technologies, work organisation, socioeconomic conditions, globalisation/relocation of jobs, etc.?**

The demand-side forecast prolongs past trends in sectoral and skill structures into the future. In this way the German approach implicitly accounts for exogenous factors, considering that they drive these trends. The forecast does not attempt to isolate the quantitative role of specific factors, however. Only a qualitative discussion makes the potential forces behind the trends more explicit.

In addition to the baseline projection reflecting the status quo trend associated with non-cyclical changes in economic structures, certain exogenous factors are designed in an ad hoc manner for sensitivity tests. Issues addressed in this way are the role of immigration, the

impact of female labour force participation and later retirement due to pension, as well as future economic convergence or divergence between the East and West German regions.

**Question 7: Which classifications are in use at different stages of forecasting?**

The following discussion focuses on the demand-side forecast, since it produces the more disaggregated output.

At the first stage of forecasting, workers are assigned to sectors according to the NACE classification. To avoid small sample size problems in further steps, certain sectors are considered together, which reduces the number of sectors in the final classification to nine. In principle, a richer analysis distinguishing between sectors A-Q would be possible, however.

At the second stage of forecasting, workers within sectors are assigned to five formal classification levels, which follow a country-specific classification and are not directly compatible with ISCED. In principle, transformation of the results into ISCED is possible, though with some imprecision due to minor idiosyncrasies in data collection (see qualification explanation below).

At the third stage of forecasting, workers within sectors who have completed university education are assigned to 13 fields of study. The classification of fields of study is based on a more detailed classification employed by the Federal Statistical Office. However, for the analysis a more aggregated approach is necessary not only to avoid small cell sizes, but also to cope with a change in the official classification scheme. As a result, the classification of fields of study in German skill needs forecasts will not be directly compatible with international ones.

At a separate stage of forecasting, workers within sectors are assigned to occupations according to the standard classification of occupations underlying the German micro census. This detailed classification is reduced to 22 occupation categories via aggregation. This avoids small sample problems and reduces the potential for transitions between occupations that in performing the forecast would be difficult to handle.

This approach has the advantage of generating occupational figures compatible with those contained in German employment statistics on the basis of social security records, which employ a compatible classification scheme. On the other hand, the occupation classification is not at all compatible with ISCO. The micro census has recorded occupations according to ISCO only in more recent waves. Further, government contractors appear concerned that the ISCO classification in general is not particularly useful in the German context.

The supply-side forecast for the population with completed education focuses on the five formal qualification levels specified above. In addition, the forecast classifies the population still in education according to the type of schooling, using a very comprehensive classification scheme, which could be made compatible with ISCED.

**Question 8: Data sources and quality**

**(a) Which data and data sources are used at different stages of forecasting?**
**(b) Please indicate the quality of data input.**
**(c) Please mention the minimum length of time series required where applicable.**
**(d) Please – in sample surveys – specify the sample, its representativeness, and the regularity/frequency of the survey.**
**(e) Where data come from the national census, please indicate its frequency and possible combination with other data sources.**
**(f) How do you organise access to these data?**

At macro level, employment and growth statistics are taken from the National Accounts statistics. Demographic information is taken from the population forecasts conducted by Statistical Offices (*koordinierte Bevölkerungsvorausrechnung*).

Structural information at micro level concerning employment by sector, skill and occupation is obtained from the German micro census, a 1 % sample of the population. Micro census data are also employed to compute participation rates by age, gender and skill entering into the supply-side forecasts.

Complementary micro level information on processes and transitions within the education system comes from education statistics provided by the Federal Statistical Office and Higher Education Information System, a private agency regularly collecting detailed data on university students, including dropout rates, on behalf of government authorities.

The quality of the data inputs is generally good.

However, construction of consistent time-series occasionally poses problems both at macro and micro level. At macro level, it becomes more and more difficult to obtain aggregate data for East and West Germany separately, although regional disparities are still so large that separate forecasting models are essential. On the disaggregate level, some micro census information is incomplete as relevant data are gathered only every year, or inconsistent over different waves due to changes in recording or classification schemes.

Further, a fundamental problem of the micro census is underreporting of minor employment relations. As a result the employment rates calculated on this basis are markedly smaller than those derived from national accounts statistics. The latter would not allow any disaggregation by skills, however.

A general answer to this question is not possible. The longer the available time series, the more advanced econometric modelling techniques can be employed. Long-term extrapolations based on less than 10 observations are definitely highly uncertain, and allow only very robust forecasting techniques.

The time series entering the German skill needs forecasts are of different length: for West Germany, national accounts statistics reach back to 1970, whereas micro census data is available only from 1985. For East Germany, both macro and micro statistics are available from 1991. However, due to the economic turmoil at the onset of the economic transition, effectively only data points from 1995 can be used. In view of these short time series, forecasting for the East German region necessarily heavily relies on ad hoc assumptions rather than proper trend estimates.

The micro census is a one percent rotating panel representative of the German population, which is collected each year during the period April/May. However, certain variables relevant for skill needs forecasting, notably the field of study of university graduates, are not recorded annually, but only bi-annually or triannually.

National Accounts statistics at the required level are basically for public use.

Access to the full version of the German micro census is rather difficult, as the data contained in this survey are protected by data security legislation. This prescribes that the full data set is not directly accessible for the analyst, but only through the ‘data centre’ at the Federal Statistical Office. This means that researchers have to send retrieval programs to a data centre,

which checks the program codes, runs them, and returns the output after checking the results for violations against the principle of anonymity. This principle requires that any cell in a table, or obtainable by combinations of tables, must represent at least 1 000 individuals. This limitation causes serious practical problems, because many sector-skill cells are sparsely populated. Moreover, the data security control mechanism at the data centre of the Federal Statistical Office operates slowly.

As an alternative, one may work with a 70 % subsample of the micro census, which exists in two versions. A first version is not fully anonymous and, therefore, still requires access through the Statistical Office. However, a simplified data security procedure is applied, which substantially speeds up the process of data collection. The ongoing skill needs forecasts in Germany use this channel to the micro census data.

An alternative possibility would be fully anonymous scientific use versions of the micro census, available to researchers upon application. However, scientific use files are not yet available for each wave of the micro census. Further, one may have to tolerate a loss in data quality due to the routines applied for data protection.

**Question 9: What is the output of the forecast?**

On the demand-side, the forecast at the aggregate stage produces the development of total employment, distinguishing fully employed workers, apprentices and individuals on minor employment contracts. At all later stages focusing on skills, the forecasts only consider fully employed workers.

At the first stage, the forecast produces the demand for workers for five levels of formal qualification within nine sectors.

At the second stage, the forecast produces the demand for workers with a degree from a university of applied sciences (*Fachhochschule*) respectively a degree from a university, distinguishing 13 fields of study. These forecasts are based on the development of fields of study within each of the nine economic sectors, but this intermediate stage of the forecasting process is not reported.

At a separate stage, the forecast produces the demand for workers distinguishing 22 occupational categories. Again, this forecast is based on the development of occupations within each of the nine economic sectors, but this intermediate stage of the forecasting process is not reported.

On the supply-side, the forecast produces the number of workers participating in the labour market according to formal qualification (five levels), as well as the number of individuals in the schooling system by type of schooling.

**Question 10: What is the period of the forecast?**

The forecasting horizon reaches up to 2035. More precisely, forecasts at the aggregate level as well as at the disaggregate levels of formal qualification, fields of study and occupation are provided up to 2020. Beyond 2020 structural parameters concerning employment shares by sector, skill and occupation are held constant. Thus, for the period 2021-35, the forecast is only informative at the aggregate level.

**Question 11: How often is the forecast repeated?**

So far, forecasts have been repeated at irregular intervals. The ongoing forecasting effort is employed to establish a standardised forecasting routine. For the future, the intention is to repeat forecasts annually.

**Question 12: Are there procedures for the *ex post* evaluation of the quality of results of the forecast? How do you assess the quality (accuracy, reliability, robustness) of the output?**

As skill needs forecasts in Germany have been produced irregularly, there are no established procedures for the *ex post* evaluation of the forecast quality.

On a conceptual level, one may question the purpose of such controls. Quite simply, economies are so dynamic that it is a priori clear that any point forecast will be inaccurate. In contrast to population developments, which unfold very slowly, structural predictions of economic processes over several decades are naturally extremely unreliable. In other words, long-term economic forecasts would only randomly meet the factual development.

This does not mean that long-term forecasting routines are useless, but they need to be interpreted in the right manner. These forecasts can condense complex multi-dimensional information about past and current trends in economic parameters into relatively straightforward indicators. These indicators are informative in two ways: first, they illustrate relative trends, i.e. answer the question whether one particular skill is in the process of becoming more or less relevant as a production input relative to other skill inputs. Second, provided skill forecasts are regularly produced in a consistent manner, changes in the indicators point to forces currently moving the economy onto a different path of skill needs.

Interpreted in this way, skill needs forecasts may be used as a qualitative early-warning system for policy actions against potential future skill shortages. The output of such forecasts, in face of the uncertainties involved, should not be used for quantitative planning purposes.

In any case, it would be preferable to base skill needs forecasts on stochastic models taking into account the empirical uncertainty about the underlying economic and demographic parameters. A stochastic specification produces confidence bands around the mean outcome of the projection ([13]), thus allowing an *ex ante* evaluation of the accuracy of the results. Although stochastic approaches address the massive uncertainty about the future economic development and, therefore, are inherently more 'reliable', German government contractors so far have refused to implement such forecasting techniques. The argument that the resulting confidence intervals in skill needs forecasts appear too wide for policy planning is actually not convincing. Government planning should not be based on conditional mean outcomes that are generally falsified by *ex post* evaluation.

**Question 13: What is the use/target group of the forecast?**

The two target groups of the forecast are administrators from ministries of education at federal and State levels (the latter responsible for provision of schooling in the German federal system), and policy-makers. One purpose of the forecast is to check if past policy measures implemented

([13]) The standard non-stochastic approach just produces this mean outcome.

in response to the outcome of previous forecasts have been effective. A second purpose is to derive guidelines for necessary future policy intervention.

**Question 14: Who does the forecast?**

The separate demand- and supply-side modules of the skill needs forecast are conducted under the responsibility of two different institutions. The supply-side computations are performed by the Fraunhofer Institute for Applied Information Technology (FIT) ([14]), Sankt Augustin, a private institution specialising on human centred computing in a process context, notably on micro simulation models. The demand-side computations are performed by the Institute for the Study of Labor (IZA), Bonn, a private research institution focusing on the economic analysis of national and international labour markets ([15]). FIT and IZA closely collaborate to harmonise their forecasts.

**Question 15: Who pays for the forecasting work and the necessary data?**

Skill needs forecasting work is paid by the Federal Ministry of Education and Research. The federal Ministry acts on behalf of *Bund-Länder* Commission for Educational Planning and Research Promotion, an intergovernmental commission for coordinating the activities of the ministries for education at the federal and State level.

By contract, the institutions performing the forecasts are responsible for acquiring the necessary data. This means that the Federal Ministry of Education and Research only partly has to pay for them, since relevant data sources are held by the forecasters anyhow. For example, a data centre providing access to the German micro census is an integral part of IZA, such that the necessary retrievals from this data sort are available at very low marginal cost.

**Question 16: What are your ideas for establishing a forecasting approach at European level? How should this activity be organised and cooperation arranged, who should be involved, should there be a platform (e.g. at Cedefop) for cooperation?**

A question that should be seriously addressed before discussing any details regarding the forecasting approach is what would be the purpose of such an effort at European level? To answer this question, it would be useful to gather opinions about the usefulness and relevance of existing skill needs projections at national level. Further, does it really make sense to aggregate skill needs to the supranational level, considering that the European labour market is still very much segmented into national labour markets due to little mobility of workers across Member States?

If a forecasting effort at European level is indeed considered useful, practical implementation should rely on the subsidiarity principle. This means that first the best possible forecasts should be produced by country experts at national level, even if this leads to non-standardised output. Standardisation at this first stage risks losing too much valuable country-specific information. If this strategy is applied, the task at the second stage then is to aggregate possibly heterogeneous national outcomes. However, aggregating non-standardised inputs is a typical problem of meta-analysis. Application of appropriate empirical techniques can produce relevant qualitative results. The information content of quantitative skill needs forecasts (see the answer to question 12) appears extremely limited anyhow.

([14]) For more information see http://www.fit.fraunhofer.de/index_en.html [cited 25.8.2006].
([15]) For more information see http://www.iza.org [cited 25.8.2006].

# Greece I

*Olympia Kaminioti and Michael Chletsos, Employment Observatory*

**Question 1: How are 'skills' defined in skill needs forecasting approaches in your country?**

The labour-market forecasting project focuses on estimating labour demand and supply by occupation, sector of economic activity and educational level for Greece and for smaller geographical units within Greece (regions). This project will identify mismatches between labour supply and demand and between educational supply and labour demand. Therefore, at the first stage of the project we focus on forecasting occupational and sectoral demand and labour supply and identifying mismatches between the two. Skills demand and supply are examined at a second stage. For the labour-market mismatches identified in the first stage, we investigate skill mismatches on this second stage. We examine mismatches with respect to formal qualifications, generic or social skills (written ability, work in a team, analytical ability, synthetic ability, problem-solving, etc.), technical generic skills (e.g. information technology skills), technical skills related to specific occupations and other characteristics/abilities such as personal characteristics or demographic characteristics (gender, age).

**Question 2: Which main method is currently used for mid/long-term forecasting of skill needs at macroeconomic level in your country?**

There is no official (main) method for mid/long-term forecasting of skill needs at macroeconomic level in Greece. Different institutions or universities carry out labour-market forecasting. We can support that they make these forecasts on behalf of the Greek government/public administration. The Centre of Planning and Economic Research (which belongs to the Minister of National Economy) and the National Bank of Greece use their macroeconomic model to forecast labour demand and labour supply on aggregate level or on level of sector of economic activity. The Ministry of National Economy also makes employment forecasts.

Employment Observatory, which is a division of OAED (Greek Manpower Organisation) and collaborates with the Ministry of Employment and Social Protection is going to develop a systematic method of labour-market forecasting annually. The goal of Employment Observatory is to collect information from various sources to make better forecasts. For that reason two different methods and databases are under development at this institution.

The first database collects annual and quarterly data from the Greek National Statistical Service (LFS data). The annual data are from 1981 and quarterly data are from 1998. These data concern both labour-market variables (employment, unemployment by gender, age, occupation, sector of economic activity) and macroeconomic variables. Using ARMA and ARIMA models we made forecasts for labour demand and labour supply. As far as the labour supply is concerned we forecast population at working age, labour and non-labour force by gender, level of education, occupation, sector of economic activity. As far as the labour demand is concerned we forecast employment by gender, level of education, occupation and sector of economic activity. We also forecast labour supply and labour demand on regional basis (13 regions). The second step is to find the determinants of labour supply and labour demand on aggregate level and estimate an econometric equation. Using these equations we make scenarios by changing the values of the determinant factors in the next years. Thus we estimate labour demand and labour supply in the

next years. Then, we disaggregate labour demand and labour supply on regional basis, on level of education, on level of occupation and on level of sector of economic activity. The third step is to develop a mathematical model based on the search and matching theory developed by Pissarides. This model contains a static and dynamic part. By giving values to the determinant variables of the equations of the model we solve this model and we estimate the unemployment rate. Then by changing the value of a specific variable control (such as tax rate, social security contributions rate, competitiveness, etc.), we estimate the new unemployment rate and the time necessary to adjust to the new situation (when the unemployment rate reaches the new level). After that, we break down the forecast level of employment /unemployment on regional basis, on the level of education, occupation and sector of economic activity.

The second database, which is going to be developed by Employment Observatory, contains information coming from a sample survey of enterprises of all sizes, regions and sectors of economic activities. This sample survey considers the proportion of:

(a) different economic size of firms (micro, small, medium and large) to total number of firms in Greece;
(b) firms at municipality level to the total number of firms;
(c) firms at level of economic activity to the total number of firms.

The first sample survey was carried out in 2003 and contains information from 7 000 firms. There were also 80 in-depth interviews with persons from public and private sectors. This year there will be a new sample survey in the region of Attiki (interviews of 1 300 firms) to implement this methodology in the whole country. We realised the problems and the limits of the first sample survey and we improved the methodology applied to collect the information we need. After the test of this methodology in the region of Attiki we are going to finalise our method and apply it to the whole country. This method has two main goals. First we want to estimate the needs of the labour force (by occupation) in the next three years by region, size of firm and sector of economic activity. The second goal is to examine skill mismatches (labour demand and labour supply skills) with respect to formal qualifications, generic or social skills (written ability, work in a team, analytical ability, synthetic ability, problem-solving, etc.), technical generic skills (for example information technology skills), technical skills related to specific occupations and other characteristics/abilities such as personality characteristics or demographic characteristics (gender, age).

**Question 3: Which methods/models are used for the input information on macroeconomic forecasting and (sectoral) employment projections?**

For our model we use forecasts on GDP growth rate and other macroeconomic and demographic data provided by the Greek Ministry of Economy, the Bank of Greece, OECD and Eurostat.

**Question 4: Does the skill needs forecasting method only include forecasts of total demand or also expansion demand and replacement demand?**

For the time being our forecasting method includes forecasts of total demand. But we are trying to collect individual data (data on LFS) from the Greek National Statistical Service and we are working on examining how we can include forecasts of expansion and replacement demand.

**Question 5: Does the method consider the supply side, and possibly interactions between supply and demand?**

Our method forecasts labour market and skill mismatches.

**Question 6: Does the approach also consider (exogenous) factors such as impact of technologies, work organisation, socioeconomic conditions, globalisation/relocation of jobs, etc.?**

We consider exogenous factors in estimating the econometric equation of labour demand and supply and in developing the mathematical model based on the search and matching theory (developed by Pissarides). For the time being the exogenous factors are related to the national and international economic environments, but we are working on including in our model variables such as work organisation, labour-market regulation, etc.

**Question 7: Which classifications are in use at different stages of forecasting?**

As far as annual or quarterly data are concerned, to use them in ARMA and ARIMA models, we follow ISCO classification, which is used by the Greek National Statistical Service, at two-digit level. This classification is also used in the sample survey but at three or four-digit level.

**Question 8: Data sources and quality**

**(a) Which data and data sources are used at different stages of forecasting?**
**(b) Please indicate the quality of data input.**
**(c) Please mention the minimum length of time series required where applicable.**
**(d) Please – in sample surveys – specify the sample, its representativeness, and the regularity/frequency of the survey.**
**(e) Where data come from the national census, please indicate its frequency and possible combination with other data sources.**
**(f) How do you organise access to these data?**

We use data from the Greek National Statistical Service, from the Ministry of the Economy, from the Bank of Greece and from OECD. We use two different groups of statistics of the Greek National Statistical Service: national accounts and LFS. Another database used by Employment Observatory contains data from the sample survey of firms at national level.

Data provided by LFS at regional level have a problem of representation of municipalities. That means the size of the sample at regional level may be not the most appropriate. Because of a different classification of regions, sectors of economic activity and occupations, there is a problem of comparison between recent and older data. Data provided by firms for the sample survey cover the whole country and all private firms and they give information based on the personal opinion of the respondent.

Annual data from LFS used in ARMA and ARIMA models are from 1981. Quarterly data from LFS used in ARMA and ARIMA models are from 1998.

The sample survey of the firms carried out in 2003 is characterised by its representativeness at firm, sector of economic activity and regional levels. The representativeness will also characterise the new sample survey, which will be carried out in the following months

**Question 9: What is the output of the forecast?**

When using ARMA and ARIMA models, output of the forecast concerns employment by sector of economic activity, by region, by level of education and by occupation at two-digit level. Using data from the sample survey the forecast output concerns the level of employment by sector of economic activity, by region, by the size of the firm and by occupation at three-four digit level. Our plan is to provide more complete forecasts (number of sectors *x* occupations, etc.). Using different values for the variables of the mathematical model we estimate a new value for the unemployment rate on aggregate level.

**Question 10: What is the period of the forecast?**

The period of forecast is from three to five years.

**Question 11: How often is the forecast repeated?**

The forecasts based on ARMA and ARIMA models and on the search and matching model are repeated each year. We hope to repeat the forecasts based on the sample survey each year or each two years. It depends on available financial resources which are quite important.

**Question 12: Are there procedures for the *ex post* evaluation of the quality of results of the forecast? How do you assess the quality (accuracy, reliability, robustness) of the output?**

We use different sources and studies to evaluate the results and we assess the situation based on economic and non-economic information to see how relevant our results are. Concerning the sample survey, we are involved in the procedure from the beginning, we control the representiveness of the sample, the method of interviews and we analyse the first interviews to check their reliability.

**Question 13: What is the use/target group of the forecast?**

The Ministry of Labour is the main user of the results. The results are expected to be used for the redesign of labour-market projects and training policy. Continuous training policy is designed by the Ministry of Labour in Greece while initial training is designed by the Ministry of Education. Therefore, the main user is expected to be the Ministry of Labour and a secondary user is expected to be the Ministry of Education.

**Question 14: Who does the forecast?**

In Greece labour-market forecasts are designed and performed by the Employment Observatory. The Employment Observatory is a semi-public organisation responsible for this work. Design of forecasting methodology and actual forecasting is a main project of the Observatory. One of its departments is dedicated to this project. This department is currently understaffed and, therefore, collaborates with universities and specialised researchers (e.g. University of Ioannina and the Associate Professor Chletsos who is in charge of improving a previous model and producing results for the next years).

**Question 15: Who pays for the forecasting work and the necessary data?**

The Employment Observatory pays for the forecasting work. It is funded by the State, so funding for forecasting work is State generated. The Observatory has obtained extra EU funding for this project from the Ministry of Labour.

**Question 16: What are your ideas for establishing a forecasting approach at European level? How should this activity be organised and cooperation arranged, who should be involved, should there be a platform (e.g. at Cedefop) for cooperation?**

It would be a good idea to establish a network of institutes at European level willing to follow similar methodology and produce comparable outcomes. Cedefop could be an appropriate institute for organising such an exercise. The Employment Observatory would happily participate in such a project. Perhaps it would be also necessary to foster cooperation between data-producing institutes as well to guarantee the flow of data. The availability of data is of critical importance in Greece since we experience great difficulty in acquiring the necessary data for the forecasting project.

# Greece II

*Ilias Livanos, Institute for Employment Research (IER)*

## Introduction

The work described below is the first attempt to create a sound employment forecasting methodology for Greece that considers international developments and their applicability to the Greek labour market. In particular, employment forecasting methodologies, such as those developed by IER, ROA and FÁS/ESRI, have been examined carefully and their application in Greece has been considered. The methodology developed calculates both the demand and supply sides. As for employment projections of demand, the multisectoral macroeconomic model E3ME is used. E3ME provides detailed projections for various sectors of the economy and was developed by Cambridge Econometrics. Regarding Greece, the author of this paper has had a consulting role for formulating E3ME's results. The present work, which consists of part of the doctoral thesis of the author in the IER at the University of Warwick, serves to encourage research in this field in small countries such as Greece, where statistical infrastructure is limited and no significant research has been undertaken.

| | |
|---|---|
| **Question 1:** | **How are 'skills' defined in skill needs forecasting approaches in your country?** |

Two definitions of skills are used, which differ for the demand and supply sides. For the demand side, skill is defined as 'occupational skill' based on the classification of occupations used by the National Statistical Service (ESYE). As for the supply side, skill is defined as the 'highest level of formal qualification' that the individual possesses. Both of the above definitions of skills, which are used in the present work, correspond to international classifications.

| | |
|---|---|
| **Question 2:** | **Which main method is currently used for mid/long-term forecasting of skill needs at macroeconomic level in your country?** |
| **Question 3:** | **Which methods/models are used for the input information on macroeconomic forecasting and (sectoral) employment projections?** |
| **Question 4:** | **Does the skill needs forecasting method only include forecasts of total demand or also expansion demand and replacement demand?** |

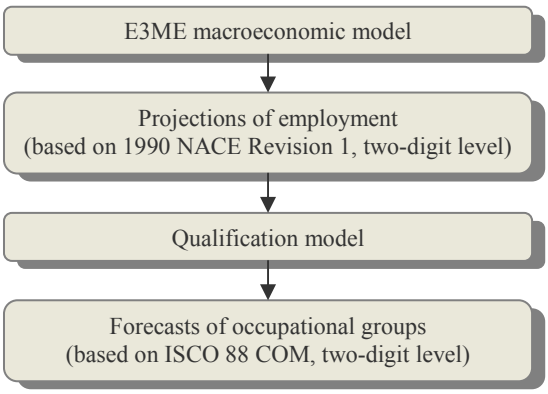
To provide a sound foundation for assessing sectoral employment projections a multisectoral macroeconomic model is required. The methodology developed uses the European sectoral model E3ME, developed by Cambridge Econometrics and was cofunded by European Commission. E3ME combines the features of an annual short- and medium-term econometric model with those of an input-output model, explaining the demand for and supply of industry output at sectoral level.

E3ME produces forecasts of employment (annual employment growth, average annual employment growth, and employment in thousands) for 41 sectors of economic activity. The forecasts of the annual employment growth are then applied to the historical data of employment in those 41 sectors to derive employment forecasts in numbers.

To derive occupational forecasts in these 41 sectors, a qualifications model was developed, which is applied to forecasts of employment. This model is based on the employment shares

of each occupational group within each of the 41 sectors. The methodology used for the demand side is described in the figure below.

*Figure 1: Forecasting methodology for the demand side*




At this initial stage of employment forecasting for Greece, only the total demand of employment is calculated. However, since the data are available replacement demand models can be calculated as well.

**Question 5: Does the method consider the supply side, and possibly interactions between supply and demand?**

The method described above considers only the demand side of employment. An additional model that has initially been developed by IER calculates the supply side of employment using LFS microdata. With the use of a multinomial logistic regression model, forecasts are made for the numbers of individuals holding different levels of qualification within the population, broken down by age group, gender and region. In this model, the dependent variable is the highest level of qualification of the individual and independent variables are: age group, gender, region of residence and a time trend. The multinomial logit model forecasts the probability of individuals holding a different level of qualification based on their age group, gender and region of residence for each year separately. The probabilities derived are then multiplied by the forecasts of employment created by the E3ME and, therefore, the forecasts of the numbers of individuals holding different levels of qualifications are derived. However, at this stage of the project, demand and supply are calculated separately and there is no interaction between the two.

**Question 6: Does the approach also consider (exogenous) factors such as impact of technologies, work organisation, socioeconomic conditions, globalisation/relocation of jobs, etc.?**

E3ME, apart from endogenous variables, also makes use of exogenous variables. Assumptions are made for variables both about developments inside and outside the EU. Outside the EU, assumptions are made regarding developments that affect Europe's economic policy. For example, growth outside the EU helps create world activity variables that are relevant for the exports equations of the 19 EU regions in the model. However, most exogenous variables related to the EU are connected with government policies such as tax rates, interest rates and government spending. Other assumptions in the model are base line assumptions for populations and the labour force, which are used in determining regional consumers' expenditure and labour force participations rates.

**Question 7: Which classifications are in use at different stages of forecasting?**

The E3ME sectoral classification that identifies 40 sectors of economic activity is based on the two-digit 1990 NACE Revision 1. The classification that the ESYE uses, Stakod 91 (Greek classification of the branches of economic activity), is also based on NACE 1.1. To produce forecasts of employment by sector of economic activity, the historical data on employment taken from ESYE are made compatible to the E3ME by transforming Stakod to the one used by E3ME. As for the occupational structure, ESYE uses STEP (classification of occupations/ professions used in Greece) which is based on ISCO (international standard classification of occupations) COM-88. The forecasts produced refer to two-digit levels.

**Question 8: Data sources and quality**

**(a) Which data and data sources are used at different stages of forecasting?**
**(b) Please indicate the quality of data input.**
**(c) Please mention the minimum length of time series required where applicable.**
**(d) Please – in sample surveys – specify the sample, its representativeness, and the regularity/frequency of the survey.**
**(e) Where data come from the national census, please indicate its frequency and possible combination with other data sources.**
**(f) How do you organise access to these data?**

The data for this work were taken from the ESYE and are all data from the LFS. Both micro- and macrodata are used for that exercise. The Greek LFS meets the standards (research design, definitions used) set by EU. It is conducted four times per year and it surveys approximately 30 000 households (80 000 individuals).

The data used for the forecasting exercise refer to the period 1998-2004 (second term). Access to the data was rather difficult and a long procedure requiring negotiations with the National Statistical Service. Both raw and published data were formally requested from ESYE. In total, more than a year was needed to get access to the data. The cost of the data was covered be the IER.

**Question 9: What is the output of the forecast?**

The forecasts refer to six aggregate and 41 disaggregate sectors of economic activity (correspondence of sectors to NACE Revision 1) and to nine aggregate and 45 disaggregate occupational categories (correspondence of occupations to ISCO 88 (COM)). For supply, the forecasts refer to eight levels of educational qualification (correspondence of educational level to ISCED).

**Question 10: What is the period of the forecast?**

The period of forecasts is short- and medium-term up to five years.

# Other issues and concluding remarks

As this project is the doctoral thesis of the author and is not funded by any government department of Greece, there are no plans to repeat it or evaluate it in the future, unless responsible agencies for employment research in Greece express an interest to fund such work and adopt this methodology. The cost of this exercise is covered partly by IER and partly by the author.

The model for the demand side, which was presented above, is an approach that can be applied at European level as:

(a) E3ME is a model for the EU that treats each country as an EU region;
(b) it uses a classification that corresponds to NACE Revision 1 on which most European counties base their classifications.

Therefore, a pan-European forecasting methodology could be based on the above structure. Also, the supply side model uses a methodology that can be applied in different countries. However, what needs to be done is to ensure interaction between the supply and demand sides which may be a rather delicate issue but the outcome of such a project can provide information about the future prospects of various occupations and it can be used as input for both policy-makers and guidance. For this purpose, a platform of both cooperation and coordination of actions is needed. Cedefop's role in such an attempt is central whereas the role of research institutes such the IER, ROA and FÁS/ESRI should also be central as they have valuable experience.

As for Greece, the present work is the first attempt to create a forecasting methodology that consists of applying best practice considering both relevant work undertaken abroad and data availability. This exercise can provide an optimistic message to many countries similar to Greece, in which limited research has been undertaken and data infrastructure is limited, namely that such a project is feasible.

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# Ireland

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## Introduction

This paper presents the approaches taken in Ireland to forecasting skill needs. Several different, but complementary, methodologies have been used in the last decades. The aim of the paper is to explain the purpose, types of outcomes and methodologies used in skills forecasting in Ireland. In particular, the paper covers three types of studies:

(a) those emanating from the expert group on future skill needs (EGFSN);

(b) sectoral studies conducted by FÁS throughout the 1990s;

(c) the national manpower forecasting project conducted by the ESRI since 1990.

It is important to recognise that, in Ireland, the phrase 'skills forecasting' is usually interpreted as referring to the number of persons employed in particular occupational groups. Most of the studies and methodologies outlined here are of this nature. There are, of course, more detailed studies of skills which are of interest to those establishing qualification standards and developing curricula. Such studies (e.g. task analyses) are not addressed in this paper.

## Development of forecasting in Ireland

The first attempts at 'manpower forecasting' were conducted in Ireland in the late 1960s/early 1970s, following the first government white paper on manpower policy in 1965 which stated that one of its objectives was 'the forecasting of changes which were likely to occur in the supply and demand for labour'. In practice, however, these early attempts failed to produce usable results. Later in the 1970s, at a time of prospective labour shortages, the government established a Manpower Consultative Committee of government and social partner representatives. The committee undertook a certain amount of research on areas such as engineering. However, changing economic circumstances brought an end to any shortages and the committee ceased to function. AnCO, the National Training and Employment Authority, established a research department in the 1970s and a range of manpower/skill studies were conducted in the period up to 1988. These included basic surveys of employment and forecasting studies in respect of particular occupations. For example, forecasts of the future demand and supply of craftspersons were made to determine the required number of apprentices that should be recruited (apprenticeship is the accepted route to qualifying as a craftsperson in a range of skilled occupations in the construction, engineering and printing sectors). During this period, the AnCO research department also established a local labour-market research function aimed at identifying growing or new occupations within a local geographical area – and hence possible additional training needs. This research involved a mixture of desk research on statistics, and discussions with companies or other key informants.

The 1980s also saw the first sectoral studies conducted by FÁS; for example of the construction and the retail motor sectors. During this period CERT, the training organisation for the hotel and

tourism industry, also undertook a certain amount of manpower forecasting in its area. Within the education system detailed skill studies were not conducted – the concentration rather being on demographic projections of the supply side.

The establishment of FÁS in 1988, incorporating the AnCO research department, led to a new focus on skills forecasting. Two main strands of research were put in place; a programme of sectoral studies for all the main sectors of the economy, and a national occupational employment forecasting system. These are presented below.

The take-off of the Irish economy from the mid-1990s soon began to lead to skills and labour shortages. Such shortages would have led to problems for companies and could have put an end to the desired growth of the economy. The government, therefore, decided in 1997 to establish an EGFSN to identify possible problems, and propose actions, to avert shortages. The work of this group is discussed in more detail below.

Overall, there are probably more resources being devoted to skills and occupational employment forecasting now than ever before. This, in general terms, reflects the acceptance by Government and policy-makers in general of the ever-increasing importance of human resources to the Irish economy in the future. There is also an increasing recognition that national studies may no longer be adequate as labour mobility increases both on a cross-border, EU and whole-world basis. Indeed, FÁS is currently in discussions with the authorities in Northern Ireland with a view to conducting skills/occupational analyses on an 'all-island' basis. Studies of sectors such as tourism and construction, and of advanced scientists, can no longer afford to ignore potentially large migration flows. However, the methodological challenges of international studies are significant.

### 1. Expert group on future skill needs

The EGFSN was established by the government in 1997. It consists of representatives of the main government ministries and agencies responsible for enterprise and industry development, the main education/training ministries and organisations and the social partners. It reports jointly to the Minister for Enterprise, Trade and Employment and the Minister for Education. It thus represents a concerted attempt to bring closer together the needs of industry and the education/training system. Forfás ([16]) provides the secretariat to EGFSN. Research is conducted either by Forfás (often delivered through contractors) or by the FÁS research department.

The EGFSN has conducted research, and published reports, across a wide range of areas ([17]). Much of its early work was concerned with shortages of professional engineers and computer specialists. The methodology for the first report included surveys of the electronic hardware and the software industries to establish the current and likely skills mix required. This information was used to supplement the standard forecasts of occupational employment growth produced by the FÁS/ESRI manpower forecasting model (see Section 3 below). Importantly, the EGFSN recognised that forecasting is an imprecise science and decided to produce three demand scenarios (high, medium and low). The EGFSN then took a policy decision that Ireland should aim for the high growth scenario and that the education/training system should aim to meet this scenario. It stated: 'The expert group believes that a proactive strategy of getting ahead of the growth in skill needs is optimal. Market forces will, in one way or another, bridge the gap

([16]) Ireland's national policy and advisory board for enterprise, trade, science, technology and innovation.

([17]) See the expert group on future skill needs website available from Internet: www.skillsireland.ie [cited 28.8.2006].

between skills demand and supply. The policy issue is whether the skills gap should be bridged by wage inflation and reduced skill demand or by increased skill supply. The group's preferred strategy is to increase the skill supply in as cost-effective a way as possible' (EGFSN, 1998, p. 18).

Forecasts of the supply of graduates from existing provision were made and, hence, a gap with future demand calculated. On the basis of these results the EGFSN recommended the provision of increased places within the third-level education system sufficient to increase graduates by 2 100 per year (compared to existing graduation levels of about 5 400). In broad terms, the recommendation was accepted by government and a major expansion of engineering/computer courses was implemented.

This brief summary is intended to highlight the policy emphasis in the work of the EGFSN. The aim of the group is not to make neutral forecasts but rather to assess what is needed to achieve a desirable future for Ireland. There have been many other studies conducted for the EGFSN which examine other areas – for example biotechnology, food, chemicals, digital media and financial services. In all these cases, government strategy is to develop these sectors and the emphasis in EGFSN research is to examine what are the manpower and skills requirements of such sectors to be successful and, if currently not met, to recommend desirable changes.

A separate and important strand of development in the last three years has been the development of a national skills database for Ireland. This database has been developed by the skills and labour market research unit of FÁS (a part of FÁS research department) and aims to gather all relevant data on employment at occupational level in Ireland. The database is organised on an occupational basis (SOC three digit) and currently includes relevant data from the census of population and LFS, various surveys of vacancies, migration, and enrolments and graduations from the education/training systems (in the future, it is intended to add further fields, especially ones relating to wages).

Although the component statistical series were available previously in Ireland, the integration of them all onto one consistent database has enabled much quicker production of data to meet specific requests. It has also eased production of summary analyses of trends and key issues. Specifically, the first issue of the *National skills bulletin* has been produced by FÁS recently (SLMRU, 2005). This bulletin has primarily drawn on data held in the skills database, but has, where relevant, drawn on the findings of other studies. The prime focus has been on existing skills and labour shortages and no new forecasts were made. However, it still serves a very useful purpose as, in the short-term, current shortages are probably the best indicator of likely future shortages. The bulletin will, therefore, assist policy formulation in the areas of employment, education/training and immigration. It also aims to provide information for students, career guidance advisers and other interested parties relating to development in the labour market.

The *National skills bulletin* does not make demand and supply forecasts. Rather it uses an indicator approach to identifying areas of shortage. These indicators cover employment profiles and trends, unemployment, vacancies, difficulties faced by employers in filling jobs, work permits and an estimated replacement (labour turnover) rate. On the basis of these indicators, occupations were classified as 'no shortage', 'skill shortage' or 'labour shortage' and the severity of the shortage also tagged.

In summary, the EGFSN has now a pre-eminent place in the Irish institutional framework. It is conducting a large volume of work, in varied contexts. Despite its success, the group recognises that in the future it may need to give a greater weight to qualitative, rather than

quantitative, studies of future needs. One part of this will be the identification of new or emerging skill needs which do not appear in any standard job or occupational classification.

## 2. Sectoral studies

As noted earlier, FÁS first started undertaking sectoral studies in the 1980s. However, it was in the early 1990s that a major programme of sectoral studies was started. The original context was the preparation of Irish industry for the single European market of 1992 but it was soon realised that such studies were of more general value to a range of stakeholders concerned with a particular sector. Sectors covered by the process included: engineering, chemicals, printing, clothing, food, furniture, footwear, textiles, retail, software.

These studies were received very positively by private companies and national organisations in Ireland, and led to FÁS setting-up over 50 specific training initiatives to meet needs identified in the studies. Towards the end of the 1990s, a process of up-dating the studies was started by FÁS and this resulted in further studies including ones on clothing, food and engineering. Sectoral studies have continued over the last five years, mainly under the auspices of the EGFSN.

In general, the aim of a sectoral study is to set out the desirable future development of a specific industry sector in the context of economic, social and other developments over a five-year time scale, and recommend the manpower and training interventions required to support this development.

Thus, one of their prime purposes is to help the various stakeholders make good decisions about manpower and training activities relevant to the sector. These stakeholders include education/training organisations, government departments, employer and union representatives and individual companies themselves.

The key components of a sectoral study are set out in Table 1.

The study is likely to set out the present position of the industry in terms of markets, enterprises, technology, labour, business performance and other factors relevant to the sector in question. It will then identify and assess market opportunities and threats using a SWOT analysis and spell-out the technological, legislative, trading and other changes likely to affect the industry.

The study will then set out the kinds of market, business, technological and manpower developments that will be required for success in the industry in the future. It may be useful at this stage to set out several scenarios based on different assumptions, and explore their consequences and, in particular, the measures needed to achieve the most favourable one. The changes that enterprises need to make to achieve such positive outcomes can then be presented as well as the manpower, skills and training changes that are required. It should be emphasised that any strategic analysis needs to be fully linked to that of government and other development organisations and build on their work as much as possible with resulting benefits to all.

Sectoral studies typically have a five-year time horizon, but also address key issues that will affect the sector over a longer time-scale. In relation to manpower needs, studies typically:

(a) provide broad indications of the number of employees requiring training and re-training, indicating the type and duration of training required over a five-year period;

(a) provide broad indications of the number of new recruits needed annually, over the five-year period, indicating the types of employees and skills required (particular attention in this is paid to occupations requiring a formal skill training programme of extended duration for which forward-planning is required if shortages/surpluses are to be avoided);

(b) prioritise the training needs of the industry so as to guide the allocation of funds;

(c) indicate the kinds of changes that enterprises need to make in the future to be successful ([18]):

(d) indicate special initiatives that may be needed to promote or develop training and human resource development (HRD) in the sector.

*Table 1: Key components of a manpower and training needs sectoral study*

| | |
|---|---|
| Current situation in the sector | Industry size and composition<br>Markets<br>Technology<br>Business performance and competitiveness<br>Employment/skills<br>Education/training supply<br>Strengths and weaknesses |
| Change factors for the future | Global competition, tariffs, trade regulations<br>Technological changes<br>Legislative changes<br>Labour-market changes and problems<br>Threats and opportunities |
| Proposed future strategic direction for the industry ([1]) | Markets; domestic and exports<br>Industry composition, supply chains<br>Technology<br>Work organisation/human resource development (HRD)<br>Other changes |
| Employment, manpower and training requirements | Numbers and types of employment in future<br>Training and education requirements (quantities and types)<br>Company HRD actions required<br>Other labour market issues to be addressed |
| Recommendations | National and industry strategic HRD policies/actions<br>Education/training providers' and funders' actions<br>Company actions (in a range of respects including HRD)<br>Other government departments' and development agencies' actions<br>Other labour-market actions recommended |

([1]) Sectoral studies might valuably give a couple of scenarios to draw out the implications of different options.

The methodology for a sectoral study usually comprises collecting and analysing existing statistics, an understanding of the business of the sector, a survey of employers in the industry, forecasts of future employment, the collection of data on existing education/training provision and putting all these elements together to form a report.

In some cases in Ireland, econometric models of future demand have been constructed: essentially relating employment demand to output demand. Output demand was projected on the basis of a business analysis of the sector, and then the resulting employment requirements were projected on the basis of the econometric relationships. Projections of total employment were then subdivided into occupational employment projections on the basis of ratios of occupational to total sectoral employment, adjusted for expected changes where known. The most extensive such modelling was undertaken by FÁS in respect of the construction industry where a model was developed involving 25 occupations with several subsectors. This model has been used regularly over the last decade to predict future employment numbers in all the

([18]) As well as being of value to enterprises themselves, this information could also be used by public bodies in any promotion-of-change efforts.

main construction occupations. In other cases, occupational/employment ratios from other countries have been used as desirable indicators (for example, these were used as one possible indicator in a recent study by FÁS of manpower requirements in the health sector in Ireland).

It is important to emphasise that sectoral studies have taken different approaches. They have all been based on a forward-looking, industry-based, strategic development approach to identifying HRD needs. However, in some cases, the emphasis has been on a quantified, numbers, approach to identify training needs, while in others training quality and skill changes have been more important. Some have emphasised developments and HRD responses within firms, others the actions required of external organisations. The nature of the industry itself, and the adequacy of the existing HRD infrastructure for the sector, are among the factors which have affected the balance of sectoral studies in Ireland.

## 3. Forecasting occupational employment in Ireland

Since 1990, the ESRI, in association with FÁS, has developed an information system which is used to identify skill needs in broadly defined occupational subgroups covering total employment in the economy.

The description of the occupational forecasting model that follows is based on the procedures adopted in making the latest set of national and regional forecasts for Ireland for the period 2001-10 (see Sexton et al., 2004).

**Question 1: How are 'skills' defined in skill needs forecasting approaches in your country?**

Skills are defined in terms of occupations which are grouped in a hierarchy based on the highest level of education completed. It runs from unskilled occupations for which only a basic level of education is required to highly skilled occupations requiring third level education (see Table 2).

*Table 2: Major occupational forecasting groups and their associated educational levels*

| Major occupational group | Educational level | |
|---|---|---|
| | ISCO 88 | Ireland |
| 1. Agricultural occupations | second | secondary |
| 2. Managers and proprietors | – | – |
| 3. Health and education professionals | fourth | degree |
| 4. Science and engineering professionals | fourth | degree |
| 5. Business, legal and other professionals | fourth | degree |
| 6. Health associate professionals | third | subdegree |
| 7. Science and engineering associate professionals | third | subdegree |
| 8. Other associate professionals | third | subdegree |
| 9. Clerical | second | secondary |
| 10. Skilled building workers | second | secondary |
| 11. Skilled maintenance workers | second | secondary |
| 12. Other skilled manual | second | secondary |
| 13. Operatives | second | secondary |
| 14. Transport occupations | second | secondary |
| 15. Sales occupations | second | secondary |
| 16. Caring occupations | second | secondary |
| 17. Other service and protective activities | second | secondary |
| 18. Unskilled manual | first | primary |

**Question 2: Which main method is currently used for mid/long-term forecasting of skill needs at macroeconomic level in your country?**

The occupational structure of employment is projected by taking account both of past trends and expectations relating to the evolution of skills and occupations. Occupational share coefficients for each sector are calculated for the data period, and linear and semi-log trend line regressions or geometric growth rates, where judged appropriate, are used to project the shares for the sectors for the target forecast year. The projected occupational shares are then applied to employment forecasts for the sectors to derive occupational forecasts for the target year in absolute terms.

*Figure 1: FÁS/ESRI occupational forecasting model*

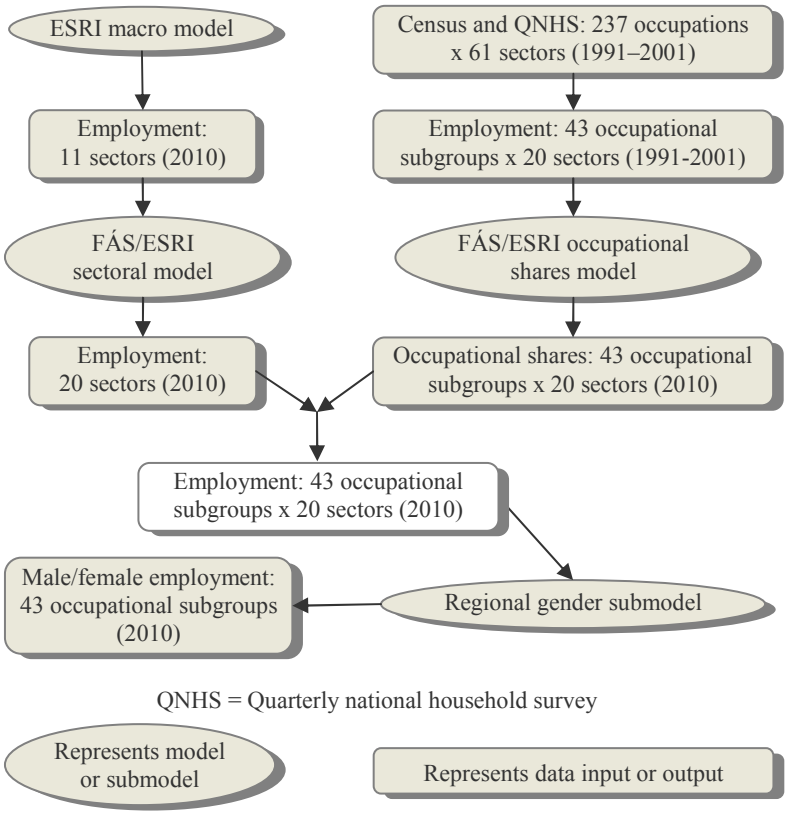


Figure 1 provides a graphical representation of the overall structure of the FÁS/ESRI occupational forecasting model. On the left hand side it shows the various steps involved in developing the sectoral projections, while on the right it shows the sequence of analyses and forecasts of occupational change within industries. In the centre it shows how these two sets of forecasts are linked to provide occupational employment projections for the year 2010.

It is an inherent feature of the method used that occupational change is, to a significant degree, influenced by developments in different sectors or industries. This does not imply that the pattern of change for different skills and occupations is not subject to other independent influences, or does not relate to a wider range of factors in society generally. None the less, the approach used does imply that the underlying sectoral pattern of output and employment growth constitutes a primary influence.

**Question 3: Which methods/models are used for the input information on macroeconomic forecasting and (sectoral) employment projections?**

The basic approach adopted involves using employment projections for the target year derived from the ESRI medium-term macroeconomic model (see Bergin et al., 2003). This model is used to provide employment forecasts for 11 broadly defined major sectors covering employment in the economy as a whole.

The ESRI medium-term model of the Irish economy focuses initially on the output and employment relationships, and examines the downstream expenditure and income consequences. The key mechanisms within the model areas are as follows:

(a) the exposed sector is driven by world demand, elements of domestic demand, and cost competitiveness;
(b) the sheltered market sector (services and building) is driven by domestic demand;
(c) the public sector is policy-driven, with treatment of borrowing and debt accumulation;
(d) wages are determined in a bargaining model and influenced by the factors that affect the supply and demand for labour – for example prices, taxes, and unemployment;
(e) the labour market is open and influenced by conditions in the UK labour market.

**Question 4: Does the skill needs forecasting method only include forecasts of total demand or also expansion demand and replacement demand?**

The occupational employment forecasts that have been made on a regular basis up to the present are based on the growth in employment (expansion demand) between the base year and the target year. However, the age cohort method of estimating net replacement demand is currently being implemented to supplement the expansion demand estimates and to derive estimates of job openings for new entrants to the labour market.

**Question 5: Does the method consider the supply side, and possibly interactions between supply and demand?**

Up to now the supply side of the labour market has been taken into account by the macroeconomic model at the aggregate level in terms of the sectoral employment forecasts. It has not been possible, therefore, to make detailed comparisons of job openings and labour supply. However, the census of population taken in 2002 has provided, for the first time, comprehensive data on the main degree and non-degree qualifications by subject and occupation. These data are currently being used to prepare demand side estimates of the expected number of job openings for apprentices in craft occupations and for third level graduates.

The potential supply of people with third level qualifications from the universities (degrees) and the institutes of technology (certificates, diplomas, degrees) is estimated from time series data on the relationship between first year enrolments and awards by level and by subject. These relationships are estimated by regressing degree, certificate and diploma awards on lagged first year enrolments at primary and postgraduate level. Comparisons are then made of the expected output of the third level education system for eight main subject areas with the number of job openings employers are projected to have for third level graduates.

In addition, estimates are made of the output of craft apprentices for six occupational subgroups using a flow model of the apprenticeship system developed by FÁS. These supply estimates are then compared with estimates of the expected number of job openings for craft apprentices derived from the demand side of the occupational forecasting model.

**Question 6: Does the approach also consider (exogenous) factors such as impact of technologies, work organisation, socioeconomic conditions, globalisation/relocation of jobs, etc.?**

The role of exogenous factors is taken into account in various ways in the macroeconomic model from which the sectoral employment forecasts are derived. For example, given the level of output in the manufacturing sector the manner in which it is produced is a consequence of exposure to world competitive forces. Irish manufacturing output prices are determined primarily in the world market place and cannot easily be altered to respond to Irish cost conditions. In other words, Irish firms trading internationally tend to be 'price takers'. The appropriate mix of labour, capital and material inputs depends on their relative prices. For example, if wage inflation outstrips rises in the cost of capital, there is some scope for substituting capital for labour in the medium-term production process. In addition to relative price terms, there is also a systematic trend in the use of some factor inputs due to technical progress. For example, in manufacturing there is a tendency towards 'labour saving technical progress', i.e. less labour is needed each year to produce the same level of real output. The determinants of technical progress are a complex mixture of catch-up factors, human capital, physical infrastructure, business efficiency, and policies targeted at innovative firms.

**Question 7: Which classifications are in use at different stages of forecasting?**

The data and forecasts provided by the macroeconomic model for 11 major sectors are disaggregated into 20 minor groups. While the industrial classifications used in these two series are different, it is possible, with relatively small adjustments, to derive a consistent series over the entire period on the basis of the NACE classification (see Table 3) ([19]).

The forecasts for the minor groups are derived by using past trend relationships involving the distribution of employment within the major sectors from 1991 to 2001. These trends are then used to project employment shares within the major sectors up to 2010, mainly on the basis of linear or semi-log regressions. The subdivision of the estimates into 20 minor groups is done mainly in order that the database used should adequately reflect the wide range of variation associated with the industrial profile of the economy. The employment estimates for some of these categories would be subject to significant sampling errors, as they are relatively small in numerical terms. For this reason the industry-based data used in the published analyses are not shown at this level of detail, but are presented in a more aggregated form involving the 11 major sectors.

The occupational classification used is the same currently employed by the Central Statistics Office in the quarterly national households surveys (QNHS) and in population censuses. It is compatible with the International Labour Office (ILO) ISCO 88 and the UK SOC. This classification was first introduced in the 1991 and 1996 censuses of population ([20]), and subsequently in the QNHS when this replaced the previous series of annual LFS in late 1997.

To simplify presentation of the occupational forecasts the 18 major occupational groups shown in Table 2 are used. They represent a combination of the major and sub-major occupational groups in the ILO ISCO 88. As such they are associated with, or regarded as broadly equivalent to education/skill levels. However, in this context, the use of educational categories as a

([19]) This is the classification which has been used in the QNHS since its introduction in 1998.

([20]) Even though the new classification formed part of the 1991 census, the related occupational data were not published at that time as the previous classification was also used. It was, however, subsequently used in the reports of the 1996 census to show comparative 1991 data on the new basis.

conceptual basis in defining skill levels does not imply that the competence necessary to perform the tasks and duties of a given job can be acquired only through formal education. The skills may be, and often are, acquired through informal training and experience.

The labels in the second and third columns associated with each functional area correspond to the equivalent or indicative educational levels as set out in the ISCO 88. In this regard level 1 in Ireland relates to primary education, level 2 to secondary education (comprising both lower and upper cycles), level 3 to higher education at subdegree or diploma level and level 4 to higher education involving the acquisition of degrees. It will be noted that management activities are not linked to formal education/skill levels because of the diverse range of educational backgrounds which this occupational category tends to involve.

The 18 major occupational groups are, in turn, subdivided into 43 occupational subgroups. These represent the most detailed occupational subdivision used in presenting the occupational forecasts. For the most part the categories distinguished can be regarded as identifying further specialised activities within the major occupational groups. The 43 categories were initially formed by grouping much larger numbers of occupational codes (numbering some 237 in total) used in the 1991 and 1996 censuses and in the QNHS from 1998 onwards. Occupational classifications tend to be subject to revision on an ongoing basis, the changes made usually involving more detail. In this regard, for the period over which past trends are observed, one is, in effect, constrained by the level of detail in the census/survey occupational structure for the earliest year. The detailed 1991 census occupational codes (unit groups also referred to as the 'project codes') are, in this sense, basic to the forecasting exercise as the data in detailed occupational tabulations taken from later censuses and QNHSs were, of necessity, subject to amalgamations to render them consistent with the 1991 figures.

*Table 3: FÁS/ESRI sectoral classification*

| MTR groups | FÁS/ESRI subgroups | NACE codes |
|---|---|---|
| 1. Agriculture | 1.1 Agriculture | 1, 2, 5 |
| 2. High-tech | 2.1 Metals | 27, 28 |
| | 2.2 Machinery and equipment | 29, 30, 31, 32, 33 |
| | 2.3 Chemicals | 23, 24, 25 |
| 3. Food processing | 3.1 Food, drink, tobacco | 15, 16 |
| 4. Traditional manufacturing | 4.1 Clothing and textiles | 17, 18, 19 |
| | 4.2 Other manufacturing (including utilities) | 10, 11, 12, 13, 14, 20, 21, 22, 26, 34, 35, 36, 37,40, 41 |
| 6. Construction | 6.1 Construction | 45 |
| 7. Distribution | 7.1 Wholesaling | 51 |
| | 7.2 Motor vehicles | 50 |
| | 7.3 Other retailing | 52 |
| 8. Transport and communication | 8.1 Transport | 60, 61, 62, 63 |
| | 8.2 Communications | 64 |
| 9. Other market services | 9.1 Finance, insurance | 65, 66, 67 |
| | 9.2 Other business services | 70, 71, 72, 74 |
| | 9.3 Hotels and restaurants | 55 |
| | 9.4 Other services | 88, 91, 92, 93, 95, 99 |
| 10. Public administration and defence | 10. Public administration and defence | 75, 90 |
| 11. Health and education | 11.1 Education R&D | 73, 80 |
| | 11.2 Health and social work | 85 |

- Note: MTR groups are 11 major sectors used in regular medium-term reviews of the Irish economy.

*Table 4: FÁS/ESRI occupational classification showing major groups, subgroups and unit groups*

| Groups | Subgroups | Unit groups and project codes |
|---|---|---|
| 1. Agricultural occupations | 1.1 Agricultural | 1601, 5950, 5940, 9010, 9030, 9040 |
| 2. Managers and proprietors | 2.1 Managers | 1600, 1000, 1010, 1020, 1030, 1100, 1110, 1200, 1210, 1220, 1240, 1260, 1300, 1310, 1390, 1400, 1410, 1500, 15201710, 1730, 1740, 1750, 1760, 1770, 1780, 1790, 1910, 1990, 7000 |
| | 2.2 Proprietors in service industries | 7020, 1711, 1731, 1741, 1751, 1761, 1771, 1781, 1791, 1991 |
| 3. Health and education professionals | 3.1 Health professionals | 2200, 2210, 2230 |
| | 3.2 Education professionals | 2300, 2330, 2340, 2390 |
| | 3.3 Clergy | 2920 |
| 4. Science and engineering professionals | 4.1 Science professionals | 2000, 2010, 2020, 2090 |
| | 4.2 Software engineering professionals | 2140 |
| | 4.3 Other engineering professionals | 2100, 2110, 2120, 2150, 2160, 2190, 2600 |
| 5. Business, legal and other professionals | 5.1 Business/finance/legal professionals | 2400, 2420, 2500, 2520, 3630 |
| | 5.2 Other professionals | 2240, 2700, 2900, 2930, 3800, 3840, 3870, 3900 |
| 6. Health associate professionals | 6.1 Health associate professionals | 3400, 3420, 3430, 3460, 3470, 3490, 3960 |
| 7. Science and engineering associate professionals | 7.1 Science associate professionals. | 3000, 3090 |
| | 7.2 Computer associate professionals | 3200 |
| | 7.3 Engineering associate professionals | 3010, 3020, 3030, 3100, 3120, 3130 |
| 8. Other associate professionals | 8.1 Catering associate professionals | 6200 |
| | 8.2 Other associate professionals | 3500, 3310, 3320, 3610, 3710, 3810, 3910, 3940, 3990 |
| 9. Clerical | 9.1 Clerks/typists/telephonists | 4000, 4010, 4100, 4110, 4120, 4300, 4410, 1320, 4900, 4590, 4600, 4620 |
| 10. Skilled building workers | 10.1 Skilled building workers | 5000, 5010, 5020, 5030, 5040, 5060, 5070, 5090, 9220, 9230 |
| 11. Skilled maintenance workers | 11.1 Electricians, electrical fitters | 5210, 5230, 5260 |
| | 11.2 Fitters and mechanics | 5400, 5150, 5160 |
| 12. Other skilled manual | 12.1 Metal/engineering craft workers | 5170, 5320, 5330, 5410 |
| | 12.2 Wood craft workers | 5700, 5710, 5790 |
| | 12.3 Clothing/textiles workers | 5500, 5530, 5540, 5550, 5560, 5590 |
| | 12.4 Printers | 5610, 5690 |
| | 12.5 Other skilled workers | 5900, 5990 |
| 13. Operatives | 13.1 Electrical/electronic operatives | 8500, 5240, 5250, 5290 |
| | 13.2 Metal/engineering operatives | 5300, 5370, 5190, 8300, 8340, 8390, 8400, 8410 |
| | 13.3 Food/drink/tobacco operatives | 5800, 5810, 5820, 8000, 8020, 8090 |
| | 13.4 Other plant and production operatives | 8100, 8120, 8140, 8200, 8210, 8240, 8250, 8290, 8510, 8600, 8620, 8850, 8870, 8890, 8920, 8930, 8950, 8970, 8980, 8990 |
| 14. Transport occupations | 14.1 Drivers | 8720, 8730, 8740, 8820 |
| | 14.2 Other transport workers | 8710, 8800, 8810, 6300, 9340, 9400 |
| 15. Sales occupations | 15.1 Sales agents | 7100, 7190 |
| | 15.2 Retail sales assistants | 7200, 6220 |
| | 15.3 Other sales workers | 7310, 7320, 9590, 7900 |
| 16. Caring professions | 16.1 Childcare and related services | 6500, 6520 |
| | 16.2 Care assistants | 6400, 6440 |
| 17. Other service and protective activities | 17.1 Army/gardai/prison officers, etc. | 6000, 6100, 6110, 6120 |
| | 17.2 Other security workers | 6150, 6190, 6720 |
| | 17.3 Catering occupations | 6210, 9530 |
| | 17.4 Other personal services | 6600, 6700, 6730, 6900, 3860 |
| | 17.5 Occupation unstated | 9980, 9990 |
| 18. Unskilled manual | 18.1 Unskilled manual | 9000, 9130, 9190, 9290, 9300, 9310, 9330, 9510, 9900, 9550, 9580 |

Full details of the occupational structure adopted are set out in Table 4. This shows the major occupational groupings, the constituent occupational subgroups and, for each of the latter, the detailed unit groups involved ([21]). It should be borne in mind that the source material used (Census and QNHS data) clearly limits the extent to which the required occupational subgroups can be precisely or accurately derived. Occupational descriptions provided by survey respondents are not always adequate to enable an appropriate code to be assigned. The basic purpose behind the special classification which has been formulated for our analyses is to identify occupational subgroups which are primarily skill related – much more so than the more standard occupational subgroups used by national statistical offices which are intended to cover a very wide range of uses. Nevertheless, it is considered that the occupational subgroups we have defined constitute relevant and distinct entities, which provide a reasonable basis for identifying the skill profiles involved.

**Question 8: Data sources and quality**

**(a) Which data and data sources are used at different stages of forecasting?**
**(b) Please indicate the quality of data input.**
**(c) Please mention the minimum length of time series required where applicable.**
**(d) Please – in sample surveys – specify the sample, its representativeness, and the regularity/frequency of the survey.**
**(e) Where data come from the national census, please indicate its frequency and possible combination with other data sources.**
**(f) How do you organise access to these data?**

### Data sources

For the sectoral forecasts involving 20 subgroups the data are compiled for the period from 1991 to 2001 using annual data from both the LFS (conducted prior to 1998) and from the QNHS from 1998 to the latest year available ([22]).

For the occupational forecasts, the basic data used are taken from the 1991 and 1996 censuses of population and from the QNHS carried out in the March to May quarter of each year starting in 1998. These sources are used to produce detailed and consistent employment data classified simultaneously by occupation and industry for the data period.

### Quality of data

The employment figures on which the occupational forecasts are based are defined according to the concept of principal economic status. In a survey or census context this means that, at individual level, the information obtained primarily represents each household respondent's view of his or her employment circumstances. Basically the approach involves requesting respondents aged 15 years or over to indicate, from a set of specified options, whether they are working for payment or profit, unemployed, in full-time education, on home or domestic duties, retired, etc. This classification formed the basis of the official national labour force estimates until 1997. It has the advantage that its use allows the derivation of consistent labour force data over an extended retrospective period. It is still used in estimating the

([21]) The unit group numbers have been adopted as the project codes with the addition of a zero or a one to distinguish between self-employed proprietors and employees in subgroups 1.1 and 2.2.
([22]) The QNHS data used relates to the second quarter of each year.

employment elements in the ESRI *Medium-term reviews*, a fact which effectively determines that the same concept has to be used in compiling the occupational employment forecasts.

**Length of time series required**

Long-time series are used to make the forecasts in the ESRI macroeconomic model. Generally they date from the early 1960s to the present. Ideally one would like to have long time series to make the occupational employment forecasts. However, we are constrained to using a relatively short period because of the introduction of a new occupational classification by the Central Statistics Office to present the results of the censuses of population from 1991 onwards. The use of the new ISCO-based occupational classification means that there are a relatively small number of observations available for estimation purposes – 1991, 1996 and the years from 1998 to date. Additional data used in previous employment forecasting exercises, relating to earlier years or the intervening years between 1991 and 1996, could not be taken into account as the occupational classifications were different. Even though this is not an ideal situation, it is considered adequate and the figures actually used do extend over a relatively long period, during which significant changes have taken place in the economy.

**Sample survey**

The QNHS began in September 1997 and replaced the annual April LFS. The survey produces quarterly estimates of the labour force. It implements Council Regulation (EC) No 577/98 which requires the introduction of quarterly LFS in EU Member States. About 3 000 households are surveyed each week to give a sample of 39 000 households in each quarter. There is a panel element to the survey as households are asked to participate in the survey for five consecutive quarters before being replaced by other households. Weighting factors are used to gross up the survey results to agree with population estimates by age, gender and region.

**Frequency of census and QHNS**

A census of population is carried out every five years. A national sample survey of households is carried out every quarter in fulfilment of the Council regulation mentioned above.

**Access to the data**

The Central Statistics Office provides the ESRI with a subset of the microdata from the QNHS carried out in the second quarter of each year. The microdata are supplied for the purpose of making the occupational employment forecasts only at the level of aggregation used in the FÁS/ESRI model.

**Question 9: What is the output of the forecast?**

Actual employment by major sector is presented for the data period on which the forecasts are based and projected employment is shown for the target year. The occupational forecasts are made using a 20 sector by 43 occupation subgroup matrix. The results of the forecasts are presented for 18 major occupational groups to provide an overview of expected developments up to the target year. The actual number employed in each occupation and each occupation's share of total employment are presented. The annual average actual and percentage changes in employment in the forecasting period are compared with employment change in the 10 years preceding the forecasts.

Gender-based classifications of the occupational forecasts are obtained by means of a separate submodel applied at the end of the forecasting process. Basically this involves the projection of past trends for the share of female employment for different occupations taking into account, where relevant, the changing nature of these trends over the period since 1991. For the 43 occupations involved these forecasts are compiled on the basis of either linear or semi-log regressions. Forecasts are shown of the number and percentage of females expected to be employed in each occupation in the target year.

More detailed results of the forecasts are presented at the level of 43 occupational subgroups. These show the actual and percentage change in employment expected during the forecast period for the occupational subgroups. An analysis is also presented of the factors influencing occupational change using shift-share analysis. This method of analysis permits the partitioning of employment change in the occupational subgroups into components representing the overall change in employment levels in the economy as a whole (the scale effect), the impact of employment change in individual sectors relative to total employment growth (the industry effect), and occupational shifts within sectors (the occupation effect).

The implications of the occupational forecasts for future levels of education are explored using a broad classification of education into primary, secondary and tertiary levels.

**Question 10: What is the period of the forecast?**

The occupational employment forecasts are made for a period of five to seven years in the future.

**Question 11: How often is the forecast repeated?**

The forecasts are made about every 18 months to two years following the publication of the latest medium-term economic forecasts in the ESRI *Medium-term review*.

**Question 12: Are there procedures for the *ex post* evaluation of the quality of results of the forecast? How do you assess the quality (accuracy, reliability, robustness) of the output?**

Evaluations of the forecasts are made when the data permit. For example, the first set of occupational employment forecasts made for Ireland for the period 1991-96 were evaluated when the results of the 1996 census of population became available. On balance, the forecasts for most of the major occupational groups were reasonably accurate falling within the generally accepted standard of plus or minus 10 % of the actual outturn. At the more disaggregated level of the occupational subgroups a number of the differences between the forecast and the outturn were greater than the accepted standard. Evaluation of later forecasts for the period from 2001 onwards has been inhibited by a change to the SOC-based occupational classification adopted for the 1996 and subsequent censuses.

**Question 13: What is the use/target group of the forecast?**

The purpose of the occupational forecasts is to provide information on employment trends by occupation for labour-market decision-makers. They provide information on the implications of existing employment trends, on the current position in occupational labour markets, on the kind of changes which can be expected in sectors and occupations in the future, and on the effect which different courses of action could have on the future level and structure of employment. The forecasts are intended to provide decision-makers in education and training, business, the trade unions and the public service with information on the changing skill requirements in the Irish economy.

The users of the forecasts include FÁS, the Department of Enterprise Trade and Employment, the Department of Education and Science, the Industrial Development Authority, Forfás, the Irish Business and Employers Confederation and the Irish Congress of Trade Unions.

The forecasts have been used in documents prepared by the Irish authorities for the EU operational programme for HRD in Ireland 1994-99, for a study of higher education and continuing vocational training up to 2010, and for a strategy document on employment trends and proposals for specific skills training.

**Question 14: Who does the forecast?**

The forecasts are produced by ESRI in conjunction with FÁS.

**Question 15: Who pays for the forecasting work and the necessary data?**

The forecasts are commissioned by FÁS.

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# Italy

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## Introduction

Employment forecasting is an exercise which has been undertaken in Italy only recently. It was about four years ago that the Institute for the Development of Vocational Training (ISFOL) commissioned two private institutes (REF and IRS) ([23]) to make occupational employment forecasts both at national and regional levels. These are currently the only occupational employment projections existing in Italy which cover the whole spectrum of occupations and, at the same time, utilise econometric techniques. So far the results of these exercises have not been made available to a wide public.

**Question 1: How are 'skills' defined in skill needs forecasting approaches in your country?**

Skills are defined in terms of occupations and not yet in terms of qualifications and/or level of education. In one of the previous exercises different levels of formal education were introduced in the model, but the poor results obtained led to their exclusion from the projections that followed.

**Question 2: Which main method is currently used for mid/long-term forecasting of skill needs at macroeconomic level in your country?**

The method follows a three stage procedure:

(a) the main method involves estimating a set of sectoral employment equations. Yearly data have been used for the period 1980-2000. The same equations have been re-estimated each time that the forecasts have been repeated. An inverted standard constant elasticity of substitution production function has been used for those sectors for which the statistical distinction between output and inputs made sense. The equations included the following regressors: labour and capital costs, value added, and a measure of total factor productivity. For the remaining sectors (public services and other small private services) a trend-based approach has been used.

Future developments of employment by sector are obtained by using projected values for the exogenous variables (see following question). It is worth noticing that this is the only part of the whole exercise for which multivariate relations have been estimated by using econometric techniques of some sophistication. For the rest of the model much less sophisticated statistical tools of analysis have been used, and they consisted essentially in extrapolation of trends and in a shift-share analysis.

Sectoral employment is firstly defined in terms of full-time equivalents. Then the number of employed people is forecast using variations of shares over time and by projecting them in the future. Employment is not disaggregated either by gender or by types of employment (autonomous or dependent);

([23]) REF, Ricerche per l'Economia e la Finanza
IRS, Istituto per la Ricerca Sociale

(b) sectoral employment forecasts are then transformed into occupational employment forecasts, by using an occupation by sector matrix. The coefficients of this matrix represent the manpower technology used in each sector, and they change over time with the production techniques. The values for these coefficients are projected in the future through a trend-based approach. For more detailed occupations this has not always been possible. When data are not available over a sufficient period of time, the matrix has been kept constant and a fixed coefficients technology has been assumed;

(c) occupational employment projections are then extended to regional level. 20 regions are considered. No employment equations are estimated at this level, but only extrapolations of regional-sectoral employment shares are used to project future developments of sectoral employment at regional level. Occupational employment forecasts are then produced by using the same occupation by sector matrix used for national forecasts. Interregional variations of the matrix are not considered, given that historical data cannot be fruitfully used (many cells would be empty).

**Question 3: Which methods/models are used for the input information on macroeconomic forecasting and (sectoral) employment projections?**

Projections of value added for the whole economy and its main sectors (industry and services) are taken from the official documents which report the government targets for future years. The same documents give qualitative information on the future developments of the other exogenous variables which appear in the regression equations (labour and capital costs, productivity). Forecasts for the same variables at a more disaggregated level are obtained by using trends and extrapolations of sectoral shares in total value added.

For the future, alternative macroeconomic scenarios, based on forecasts of well known national and international institutions, will be used in addition to those of the government.

**Question 4: Does the skill needs forecasting method only include forecasts of total demand or also expansion demand and replacement demand?**

Forecasts of replacement demand is a rather recent product of REF-IRS model. Sectoral equations and the occupation by industry matrix provide only for net changes in occupational employment. Only the last wave of forecasts (for the period 2003-08) include replacement demand. Before that, only stocks of occupational employment were considered and flows in and out of employment were not analysed.

Net changes of employment are only a minor component of job openings (i.e. total demand). However, statistics regarding job openings are most needed for employment and training policies and for career guidance. Replacement demand for each specific occupation is much higher than expansion demand (even when this is positive), because it considers the normal process of turnover that covers an enormous volume of people operating on the labour market.

People leave an occupation for many reasons: retirement, inactivity, unemployment, change of occupation. Outflows of people from an occupation, net of those that enter in that occupation, represent the measure of replacement demand that is used in the model. It is the sum of different components that are measured separately. Outflows from an occupation because of retirement are estimated on the basis of the age composition of the people employed in that occupation. Both outflows to inactivity and net occupational mobility for each occupation are taken from the information on transitions between labour-market status that is produced by the LFS. Projected values for these last components are obtained by simply extrapolating in the future historical average values.

**Question 5: Does the method consider the supply side, and possibly interactions between supply and demand?**

Although good data exist both on the demographic and occupational status, and on the level of the formal qualification of the overall active population, there are difficulties in using this information to establish a strict correspondence between qualification and specific dimensions such as occupation and sector. Most occupations are undertaken by people who have a wide range of qualifications.

The overall level of education is still increasing at fast pace in Italy, and new generations hold, on average, a higher level of formal education than the old ones. The intergenerational turnover is strongly characterised by this kind of general evolution: less qualified (in terms of formal education) people are replaced by more qualified ones, even within each specific occupation. It is extremely difficult to investigate if this kind of replacement demand implies some *de facto* over-education of the labour force or it is instead the result of a qualitative improvement which is required to perform better a specific occupation. We do not even know to what extent the experience of older workers can be considered as a substitute for a higher formal qualification of younger workers. Moreover occupational mobility (i.e. people moving from one occupation to another) takes place often without respecting some formal or informal prerequisite in terms of formal education. This happens even in the public sector, although in this sector a more stringent correspondence between occupation and formal education can be found. The available statistics confirm this impression: the same occupation, even if specified at a very detailed level, is undertaken by people with different levels of formal education.

These are some of the reasons that make it difficult to project the educational content of each specific occupation, and this is true for most occupations, although not all of them. For this reason the demand side of the REF-IRS model does not cover qualification or education, and consequently the supply side is not taken directly into consideration. As a consequence the model does not provide any form of forecast of skill shortages, surpluses, mismatches, and similar important aspects of the functioning of the labour market.

It is not excluded that in few cases there might be a stronger correspondence between an occupation and a specific level of qualification. In these cases demand and supply of a specific qualification could be better identified, and forecasts could be more easily produced. If shortages or surpluses should result, they would give useful information to all interested in providing the amount of education and in training that is needed for those specific occupations.

**Question 6: Does the approach also consider (exogenous) factors such as impact of technologies, work organisation, socioeconomic conditions, globalisation/relocation of jobs, etc.?**

The main exogenous variables are those of the employment equations, mentioned in question 2. They are:

(a) value added by major sectors (agriculture, industry and services);

(b) labour and capital costs;

(c) institutional factors related to the employment relations.

**Question 7: Which classifications are in use at different stages of forecasting?**

The sectoral classification is based on NACE (two digits). A higher level of aggregation is used when small cell size problems arise. And this is the case for projections at regional level where the number of sectors is lower than at national level. At national level 30 sectors are considered.

The occupational classification follows ISCO, two or four digits depending on the statistical method that is used to project the occupation by sector matrix. If the coefficients are kept fixed, a more detailed list of occupation is used. Alternatively, if a trend-based approach is used for sufficiently long time series, the number of occupations is reduced to 35.

**Question 8: Data sources and quality**

**(a) Which data and data sources are used at different stages of forecasting?**
**(b) Please indicate the quality of data input.**
**(c) Please mention the minimum length of time series required where applicable.**
**(d) Please – in sample surveys – specify the sample, its representativeness, and the regularity/frequency of the survey.**
**(e) Where data come from the national census, please indicate its frequency and possible combination with other data sources.**
**(f) How do you organise access to these data?**

The model is based on the use of official statistics. The National Institute of Statistics is responsible for all of them. One statistical source consists in the National Accounts which provides for all the data used for the estimation of the sectoral employment equations. The regular LFS provides information for all the indicators related to the volume of people employed, occupations, composition of sectoral employment, regional employment, outflows of people from each occupation. Recently the LFS has been reformed, and future work should take due consideration of these changes. Finally some information is taken from the decennial censuses: they are used for a more detailed description of occupations.

All official data are easily accessible to a wide public.

**Question 9: What is the output of the forecast?**

In the first stage (see question 2), the model produces forecasts for total employment of 30 sectors of the whole economy. In the second stage the forecasts extend to 35 occupations for each of the 30 sectors. Both expansion and replacement demand are projected. In the third stage the model produces forecasts at regional level, for both sectoral and occupational employment. Forecasts for much more detailed occupations (599 occupations for 35 sectors) are produced only at national level.

**Question 10: What is the period of the forecast?**

Projections refer to a period of five years. The most recent forecasts cover the period 2004-08.

**Question 11: How often is the forecast repeated?**

The forecasts were produced for the first time three years ago and they covered the period 2002-07. A third exercise has just started and it will cover the period 2005-09.

**Question 12: Are there procedures for the *ex post* evaluation of the quality of results of the forecast? How do you assess the quality (accuracy, reliability, robustness) of the output?**

There is no formal evaluation of the results of the forecasts. Every time that the exercise is repeated, the accuracy of previous forecasts is assessed against the updated data that have become available in the meantime. The differences between historical data and employment projections are attributed to lack of accuracy of different parts of the whole exercise, i.e.:

(a) the rate of growth of the economy (the scale effect);

(b) the regression equations that determine sectoral employment (the industry effect);

(c) the extrapolation of the occupation by industry matrix (the occupational effect).

The assessment of the accuracy of the forecasts conducted so far shows that projections are rather good in indicating the direction of change of both sectoral and occupational employment, but they are less accurate in forecasting employment variations. This is particularly true for more detailed occupations.

**Question 13: What is the use/target group of the forecast?**

As it has been said (see introduction) employment forecasting is a rather recent exercise in Italy. The intention is to produce a more complete and structural system that should give useful information on the future of skill needs. In any case the econometric exercise is only one component of a broader project supported by the Ministry of Labour that also include more specific surveys on skill formation and skill needs conducted at sectoral level. They will give both qualitative and quantitative information on the likely changes in the occupational composition of different sectors that will take place in the future. The broader project includes also a research work to be done by the National Institute of Statistics that should shed light on the skill content of each detailed occupation.

The econometric exercise is then considered only a component of a large system of different instruments that should be activated together to collect information on future skill needs.

**Question 14: Who does the forecast?**

The econometric exercise and the rest of the work are done by two private institutes for research, REF and IRS, both located in Milan.

**Question 15: Who pays for the forecasting work and the necessary data?**

The financing institution is ISFOL, a public institute that does research in vocational training and employment policies. It is located in Rome and it works under the supervision of the Ministry of Labour. It has several projects that are financially supported by the European Social Fund. The whole system of gathering information on future skill needs is one of these projects.

**Question 16: What are your ideas for establishing a forecasting approach at European level? How should this activity be organised and cooperation arranged, who should be involved, should there be a platform (e.g. at Cedefop) for cooperation?**

One problem is that there are already national projects that present strong differences in many important aspects: different methodologies, different data sets, etc. The EU has recognised the importance of skill needs projections as a tool for training and labour-market policies. The EU itself, with the help of Cedefop, can play a role. First it can organise a forum where national experts exchange views and comment on national results. Second a pan-European econometric model could be developed. It should be rather simple at first stage, providing only for occupational employment projections for each Member State, and excluding the supply side (that is more controversial). It should use Eurostat statistics and it should produce forecasts that would be complementary to those obtained through national models. Differences in results should be discussed at the meeting of the forum.

# The Netherlands

*Frank Cörvers, Research Centre for Education and the Labour Market (ROA)*

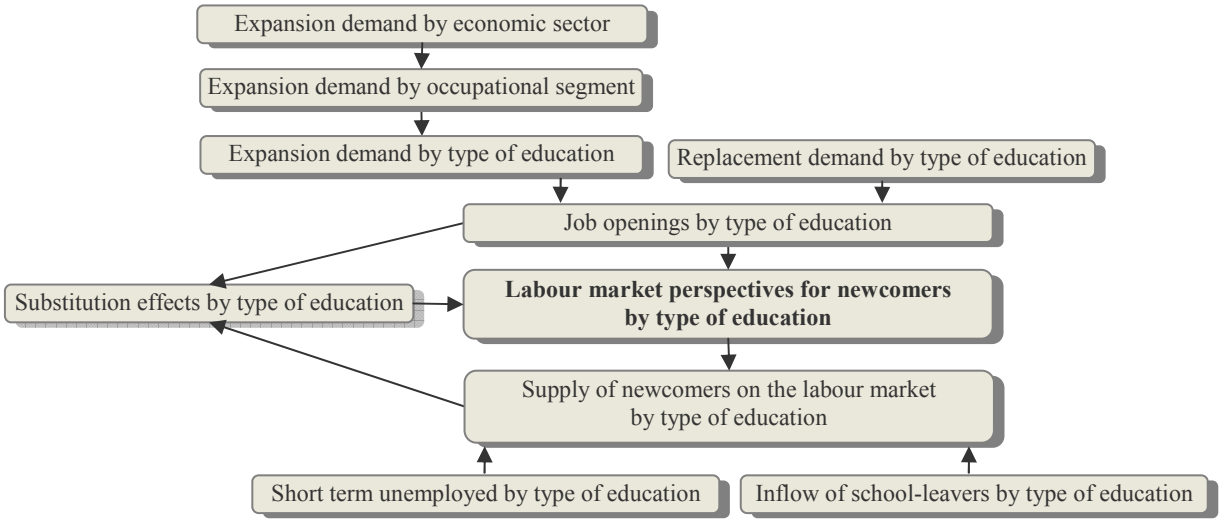
**Question 1: How are 'skills' defined in skill needs forecasting approaches in your country?**

Skills are defined by more than 100 different occupational groups and types of education. The occupational groups are in some models (for expansion and replacement demand) aggregated to 43 occupational segments or 27 educational categories. The forecasting results are often presented by using classifications of 11 occupational classes or 27 educational categories.

These classifications cover the whole spectrum of skills on the labour market and are compatible with the classifications of Statistics Netherlands (CBS – *Centraal Bureau voor de Statistiek*) and, therefore, with ISCED and ISCO.

**Question 2: Which main method is currently used for mid/long-term forecasting of skill needs at macroeconomic level in your country?**

*Figure 1: ROA's labour-market forecasting model*




*Source*: De Grip, Borghans and Smits, 1998.

Figure 1 gives a schematic review of the labour-market forecasting model. One flow volume important for the demand side of the labour market is expansion demand, which reflects the movement in employment levels in a particular occupational class or for a particular type of education. Forecasts of expansion demand are based on employment level forecasts for economic sectors produced by the CPB Netherlands Bureau for Economic Policy Analysis. Because particular occupational classes within an economic sector grow more rapidly than others, ROA translates these changes in economic sectors into expansion demand per occupational class. Then the implications of predicted growth in various occupational classes for expansion demand for each type of education are determined. Allowance is made at this point for any shifts occurring in the educational structure of occupational classes (including upgrading within occupational classes). Expansion demand per type of education refers to the number of people with a particular educational background that employers would like to be able to employ. The

actual change in employment levels per type of education generally differs with this because changes on the supply side affect relative scarcities and lead to substitution.

Labour-market demand consists not only of expansion but also of replacement demand, which arises when workers retire, leave the labour force under an early retirement scheme or because of a disability, withdraw from the labour market temporarily, or switch to another occupation, etc. However, replacement demand only arises if the departure of an employee actually leads to a vacancy for a new entrant. If the departure of a worker is taken as an opportunity to cut employment levels, no replacement demand results. These flows out of the labour market are irrelevant for newcomers.

Thus, only parts of the flow leaving the market create replacement demand. There is also an important difference between replacement demand per occupational class and per type of education, because occupational mobility has an influence on replacement demand per occupational class, but not on replacement demand per type of education. Switching occupations has no effect on the educational structure of employment. However, when workers complete part-time studies for a higher level or different qualification, this represents an outflow of workers to another educational category (type of education). In these cases, replacement demand does arise in the educational category under which a worker's previous education was counted.

If employment levels rise, expansion demand and replacement demand together compose the job openings for newcomers to the labour market. If they fall, job openings can only arise because of replacement demand.

To be able to show future labour-market prospects for newcomers to the labour market, we have to compare job openings for newcomers with the expected supply of newcomers. The latter consists of the future flow of school-leavers entering the labour market and the outflow from post-initial training courses during the forecast period, plus the supply of short-term unemployed persons waiting to enter the market at the start of this period. It is assumed the long-term unemployed, who have been looking for work for longer than a year, no longer constitute serious competition for school-leavers.

An indication of future labour-market prospects for newcomers to the labour market is calculated, for each type of education, by comparing the expected flows of demand and supply with each other. This indicator shows any expected discrepancy between demand and supply for each type of education. Excess supply does not necessarily imply the group in question will automatically become unemployed, or a supply shortfall does not automatically lead to unfilled vacancies. In practice, school-leavers with a type of education for which supply exceeds demand suffer from a worsening of their position. They are more likely to have to accept work below their level, get less favourable contracts, be paid less and more likely to work part-time involuntarily (Wieling and Borghans, 2001). In such situations, employers normally adjust their demands and recruit people with a higher educational background. However, if there is a supply shortage, school-leavers will not have to accept a job at a lower level, for lower wages, etc.

Because of substitution processes, there are fewer job openings for those suffering from 'crowding-out' with types of education in excess supply. However, for those with educational backgrounds closely related to types of education in short supply, there will be extra job openings. These passive substitution effects are thus important determinants of labour-market prospects for types of education.

**Question 3: Which methods/models are used for the input information on macroeconomic forecasting and (sectoral) employment projections?**

Macroeconomic employment forecasts and employment level forecasts for economic sectors are produced by the CPB Netherlands Bureau for Economic Policy Analysis, the official institute of economic forecasting for the Dutch government. However, recent medium-term forecasts are not always available. To correct for actual business cycle effects, ROA often combines the short-term sector forecasts with the medium or long-term sector forecasts, after consulting CPB.

**Question 4: Does the skill needs forecasting method only include forecasts of total demand or also expansion demand and replacement demand?**

The skill needs forecasting method includes forecasts of total demand as well as forecasts of expansion demand and replacement demand.

**Question 5: Does the method consider the supply side, and possibly interactions between supply and demand?**

The forecasting method includes the supply side, as well as interactions between supply and demand.

**Question 6: Does the approach also consider (exogenous) factors such as impact of technologies, work organisation, socioeconomic conditions, globalisation/relocation of jobs, etc.?**

Most of these factors are accounted for in the macroeconomic and sector modelling by CPB. In the ROA model of the occupational structure of 13 economic sectors the impact of changing technologies (measured by R&D and capital investments) is accounted for and scale (value added) on the occupational employment shares per sector. In the ROA model of the educational structure within occupations upgrading is accounted for. In the replacement demand model changes (including forecasts) of labour force participation rates (per age-gender class) are accounted for.

**Question 7: Which classifications are in use at different stages of forecasting?**

See the answer to question 1.

We differentiate between 13 economic sectors which are compatible with ISIC/NACE.

**Question 8: Data sources and quality**

**(a) Which data and data sources are used at different stages of forecasting?**
**(b) Please indicate the quality of data input.**
**(c) Please mention the minimum length of time series required where applicable.**
**(d) Please – in sample surveys – specify the sample, its representativeness, and the regularity/frequency of the survey.**
**(e) Where data come from the national census, please indicate its frequency and possible combination with other data sources.**
**(f) How do you organise access to these data?**

ROA uses national data sources. Both use of national data sources and forecasting with a general – as distinct from partial – model, represent the top-down approach by ROA. By using these, ROA ensures its labour-market forecasts are consistent with authoritative forecasts which provide the basis for policy decisions on important social and economic issues in the Netherlands. The data sources used cover all segments of the labour market, are consistent with other

important national economic developments, for example GDP growth, employment growth, demographic trends, and can be consistently differentiated to lower levels of aggregation. These data sources are available nationally on a yearly and coherent basis.

The use of national forecasts applies especially to changes in employment, capital investments and value added in various sectors of industry, and forecasts of participation rates by age-gender class. These forecasts are officially published by the CPB Netherlands Bureau for Economic Policy Analysis.

An important data set is the LFS of CBS. The LFS provides information on the number of working people, analysed by economic sector, occupation, training, age, gender and working hours. The LFS is a 1 % sample of the Dutch population between 15 and 64 years old. CBS does not allow publishing of figures below 5 000 persons per cell. Access to the data is provided by working on site at CBS. Matrices of sector *x* occupation (13 x 43) are available since 1988, although with some breaks. Recently, CBS has compiled a new data set based on the LFS between 1996 and 2003. This data set is used for compiling the replacement demand by occupation and education, and for further disaggregating the expansion by occupation and education. For 2004 a new break is expected with regard to the type of education, due to another way of surveying.

Forecasts of the flows of school-leavers entering the labour market match the *Referentieramingen* (reference forecasts) compiled by the Ministry of Education, Culture and Science for courses in the 'regular' (full-time initial) education system. ROA disaggregates these forecasts by using supplementary data from education matrixes of CBS and information on the number of students and graduates in various types of education. These data are based on pupil, student and graduate counts by schools and universities, and cover the whole regular system of education. These data are directly available in a similar format since 1997 and 1990 for secondary education and tertiary education, respectively.

Supplementary data concern the school-leavers information (first destinations). ROA is coordinating several extensive surveys on the match between initial education and first destinations of school-leavers on the labour market. This means that representative information is available on graduates across the full range of full-time education. Almost all graduates from tertiary education are interviewed, and about 10 % of the graduates in secondary education. These data are available since 1996.

**Question 9: What is the output of the forecast?**

Expansion demand:

(a) sector forecasting: 13 economic sectors (CPB);

(b) occupational structure with explanatory variables: 13 economic x 43 occupational segments (LFS, two-digit ISCO);

(c) differentiating occupational structure (random coefficient model): from 43 occupations segments to 127 occupational groups (LFS, three-digit ISCO);

(d) forecast of educational structure: 127 occupational groups x 110 types of education (LFS, three-digit ISCO and ISCED);

(e) upgrading: 43 occupational segments x 27 educational groups (LFS, two-digit ISCO and ISCED).

Replacement demand:

(a) cohort modelling of occupations: 127 (or 43) occupational groups (segments when reliable data are lacking) x 10 age classes by gender (LFS, two- or three-digit when reliable data are lacking);
(b) cohort modelling of types education: 110 (or 27) types (groups when reliable data are lacking) of educations x 10 age classes by gender (LFS, two or three-digit when reliable data are lacking).

Inflow on the labour market:

(a) forecast by education: about 6 groups per level of education (Ministry of Education);
(b) differentiating by education to 110 types of education (graduate counts, education matrix and first destinations, CBS and ROA).

NB: more than half of the cells in matrices are empty, since these combinations do not occur.

**Question 10: What is the period of the forecast?**

Period of the forecast is five years.

**Question 11: How often is the forecast repeated?**

The forecast is repeated every two years.

**Question 12: Are there procedures for the *ex post* evaluation of the quality of results of the forecast? How do you assess the quality (accuracy, reliability, robustness) of the output?**

The results of the forecast are evaluated at the end of the forecasting period. The evaluation is based on three criteria (Granger and Newbold, 1986):

(a) Are the forecasts better than the available alternatives?
(b) How good are the forecasts relative to naive forecasts?
(c) Can the forecasting method be improved so a better forecasting quality may be expected?

**Question 13: What is the use/target group of the forecast?**

Two main functions of labour-market forecasts are: policy and information (Van Eijs, 1994). The policy function refers to the usefulness of labour-market forecasts for government policy-makers, public employment services and employment agencies, employers' organisations, unions and educational organisations. Policy-makers often want to be informed of supply and demand developments at a more aggregate level. ROA biennially publishes a report *The labour market by education and occupation to 200x*, which includes analyses of expected labour-market developments in the light of particular policy issues. There is also a digitalised data set made available for ROA's own use and presenting all forecast and other labour-market information (first destinations and information from the LFS) in a systematic way. This information system allows users to select their own tables, for example to get a detailed table of a particular labour-market segment or to compare various types of education or occupational groups with one another.

The information function is primarily intended to assist with vocational and educational guidance. This improves the functioning of the labour market, since individuals are better able to adjust their human capital investment decisions to labour-market prospects of types of education (Borghans, 1993). Also, firms may use labour-market forecasts as 'early warnings' on future recruitment problems to anticipate human resources policies. The information focuses on medium-term labour-market forecasts, to give those making choices on further studies, the

best possible information on the state of the labour market when they complete their studies. Two expertise centres (National Careers Guidance Information Centre [LDC] and Choice) and the national employment agency (CWI) incorporate ROA's labour-market information in various information products for vocational and educational guidance and counselling. Besides civil servants from many different ministries (e.g. education, social affairs, economic affairs, agriculture) and public employment services, educational institutes, personnel managers, advisory councils, etc., all use different parts of the information system for their decision-making.

**Question 14: Who does the forecast?**

The forecasting is conducted by ROA.

**Question 15: Who pays for the forecasting work and the necessary data?**

The research is carried out by a team of about 10 researchers (about four full-time employees per year). There is an advisory committee of professional experts headed by an independent chairman (university professor). Financial matters are discussed and negotiated in a committee of the financing partners. The project was originally (in 1985) financed on a five-year base, later on a three-year base. Nowadays, the budget and activity plan is negotiated every year, although there is gentlemen's agreement to continue the project for the forthcoming years. The budget is split into two parts: a base part and an additional part consisting of the delivery of information for specific users. The base part is financed now by the Ministries of Education and Agriculture, CWI, LDC, Randstad (a temporary employment agency), and some institutes with specific tasks in the field of education and the labour market. Additional activities are financed by an institute producing and publishing information products for students' choices (Choice) and by CWI. All labour-market information is available upon request. However, to prevent free riding, large clients (e.g. professional or trade organisations, large business firms) have to pay for the labour-market information in case of extensive requests. In case of small requests for labour-market information by, for example, journalists of newspapers or periodicals, the information is provided free of charge.

**Question 16: What are your ideas for establishing a forecasting approach at European level? How should this activity be organised and cooperation arranged, who should be involved, should there be a platform (e.g. at Cedefop) for cooperation?**

It is important to think about the goals of an European forecasting system. These determine, for example, the level of aggregation, the forecasting period and the way of publishing the results.

The use of data sets that are available in all EU Member States is important (e.g. LFS). The approach should be top-down. Similar classifications (ISCO and ISCED) should be used for all countries.

If one of the goals is to benchmark forecasting results, just a few institutes (perhaps only one) should conduct the forecast. All other national institutes should provide the necessary data or should be involved in consulting. The coordination and consulting activities could be organised by Cedefop.

A European forecasting system will probably always be complementary to national forecasting.

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# Poland

*Elzbieta Majchrowicz; Governmental Centre for Strategic Studies (RCSS)*

**Question 1: How are 'skills' defined in skill needs forecasting approaches in your country?**

In Polish forecasting skills refer to occupational activities (based on the classification of occupations) educational attainment.

**Question 2: Which main method is currently used for mid/long-term forecasting of skill needs at macroeconomic level in your country?**

In forecasting activity a system of forecasting labour demand is used, created as the result of several years' work of the intergovernmental task force on forecasting labour demand. The task force was established within the Governmental Centre for Strategic Studies (RCSS) as an auxiliary body for the Council of Ministers in 1998.

The chairman of the task force is the vice-president of the RCSS, the vice-chairmen are the vice-president of Central Statistical Office (GUS) and the deputy Minister for Labour. The members include representatives of RCSS, GUS, relevant ministries (e.g. for education, health, economy, infrastructure, etc.), experts from scientific institutions and employers' organisations.

The various responsibilities of the task force are:

(a) initiating studies, working papers and research related to forecasting the situation on the labour market;
(b) defining needs in terms of information sources necessary to conduct labour demand projections;
(c) consulting and approving research methodology and programmes for implementing particular parts of the forecast;
(d) periodically presenting conclusions emerging from the forecasts to the Council of Ministers.

However, the major objective of the task force – according to the enacting regulation – was to draw up a concept for a computerised integrated system of forecasting labour demand in Poland. The rationale of establishing such an instrument is obvious and unquestionable: knowledge of the labour market should be based on reliable and credible information, i.e. gathered, verified, processed and updated by a rational and objective information system. Therefore, due to existing limitations it was necessary to create an appropriate system of forecasting the situation on the labour market as a prerequisite for adequate planning and programming of economic, social and education policy.

The contractor of the computerised system was the chair of spatial econometrics at the University of Lodz – selected in the public procurement procedure. The system was finally completed in November 2004. It is available to the general public although access to certain modules (e.g. forecasting models and methods, database) is restricted. Nevertheless, verified forecast outcomes can be utilised by various users.

The role of forecasting is multiple:

(a) allows decision-makers and politicians competently to inform society about expected changes on the labour market, related to projected directions of economic development;
(b) enables more optimal allocation of human resources;

(c) allows timely planning of changes to the education system;

(d) helps prepare and organise upskilling and retraining persons performing occupations for which demand in the labour market will decline;

(e) these data, provided to pupils and students before they take decisions on further education or training, will help them plan their educational and professional careers in a more informed way.

The system of forecasting labour demand applies a range of forecasting models and methods of which the most significant are:

(a) exponential smoothing – uses past information on a given variable and eliminates certain disturbances. The methods subdivides into several models:

  (i) simple exponential smoothing – Brown method,

  (ii) exponential smoothing with linear trend – Holt method,

  (iii) exponential smoothing with linear trend and seasonality – Winter method.

  Each of these functions occurs in two variations: with optimisation of the mean absolute percentage error in terms of the smoothing parameters or without optimisation;

(b) the trend model with seasonality – used in situations where the given time series shows trends of development;

(c) the autoregressive model – does not explain quantitatively relations between the explained (dependent) and the explanatory (independent) variables which is an advantage where a researcher is not sure what variables should be included in a set of explanatory variables or has difficulties in acquiring the relevant statistical data. It is assumed that the value of variable projection in a certain period depends on the value of this variable in the preceding period;

(d) the single equation model – linear regressive model which allows generation of forecasts based on cause-effect dependence;

(e) vector-autoregressive models – multi-equation models in which each variable is explained with its own lags and lags of the remaining explained variables. These are simple multi-equation models in which the relations between the individual equations are visible only in relations between the random effects of those equations;

(f) multi-equation models – seemingly unrelated (regression) SUR – multi-equation simple model which parameters are estimated jointly having regard to the assumption of correlation of random effects between individual equations;

(g) macroeconomic forecasts – formulated on the basis of scenario-simulation analysis having regard to various assumptions concerning the forms of economic instruments (exogenous variables in the model);

(h) expert forecast – within the system the user is able to generate a forecast of every single variable included in the database and to determine its course arbitrarily. This element can correct projections made with other models in a situation where the user does not accept the received results;

(i) ZBSE forecast – prepared by the economic-social analysis task group (the group no longer exists).

**Question 3: Which methods/models are used for the input information on macroeconomic forecasting and (sectoral) employment projections?**

In macroeconomic forecast and total employment projections simultaneous multi-equation model (W8P developed by Prof. W. Welfe) is utilised.

In case of breakdowns (by occupations, sections of activities, education, gender, age) we use exponential smoothing, autoregressive model, vector-autoregressive model and the trend model with seasonality.

**Question 4: Does the skill needs forecasting method only include forecasts of total demand or also expansion demand and replacement demand?**

All the methods applied include only forecasts of total demand. More specifically the analysis concerns projections of number of employees in occupations, sections of activities, levels of education and regions. Due to the lack of research on job offers, the number of employed people is identified with labour demand.

**Question 5: Does the method consider the supply side, and possibly interactions between supply and demand?**

The methods do not consider the supply side and its possible interaction with the demand side. It has been considered if the system should be broadened with the supply side but it has not yet been decided whether and when it will be done.

**Question 6: Does the approach also consider (exogenous) factors such as impact of technologies, work organisation, socioeconomic conditions, globalisation/relocation of jobs, etc.?**

At macroeconomic level (the total number of employees) and in the breakdown by regions and major ISCO groups multi-equation causal models are used. These models acknowledge external factors influencing the number of employed (i.e. consumption demand, legal regulations, situation on the labour market, salaries/wages, level of prices, etc.). The remaining breakdowns (occupations, sectors of activities) are time series and do not consider any of the mentioned exogenous factors.

**Question 7: Which classifications are in use at different stages of forecasting?**

The system of forecasting labour demand is based on the classification of occupations for the labour market (regulation of the Ministry of Economics and Labour of 2004). The classification fully conforms to the ISCO 88 and its new edition of 1994 ISCO 88 (COM) adjusted to the needs of the EU. The basic layout of the Polish classification, the classification criteria and the system of codes have been adopted according to the ISCO standard.

The classification of occupations is a five-level hierarchical collection of occupations and specialities functioning on the labour market. It groups respective occupations in more and more aggregated groups and sets their symbols (codes) and names.

Regarding use of ISCED, there are some references to it in the commentary on the classification of occupations. However, these two classifications do not fully correspond to one another.

The system also uses the Polish classification of activities – based on the NACE classification – hence the Polish classification of activities is fully consistent and comparable to NACE in terms of methodology, definitions, scope and codes.

**Question 8: Data sources and quality**

**(a) Which data and data sources are used at different stages of forecasting?**
**(b) Please indicate the quality of data input.**
**(c) Please mention the minimum length of time series required where applicable.**
**(d) Please – in sample surveys – specify the sample, its representativeness, and the regularity/frequency of the survey.**
**(e) Where data come from the national census, please indicate its frequency and possible combination with other data sources.**
**(f) How do you organise access to these data?**

In macroeconomic forecasts macroeconomic data produced by GUS are used (e.g. current budget expenditure, budget revenue from different sources, private consumption, the volume of export, gross domestic product, inflation).

In forecasting labour demand the following data sources are used: data derived from LFS and data collected by labour offices (e.g. registered unemployment, number of job offers, etc.).

The quality of data is satisfactory.

Macroeconomic data are yearly data and quarterly data collected since 1960.

The LFS has been carried out since 1992, however the method of permanent observation in quarterly periods has been applied since the fourth quarter of 1999.

The LFS sample comprises around 20 000 random households. The survey is fully representative. It covers persons aged 15 and above, including foreigners. The survey is conducted by permanent observation, i.e. the economic activity is measured each week of the quarter.

However, the results of the survey conducted in 2003 have been generalised – adjusted to the data derived from the national census of 2002 and are not fully comparable to the results of the surveys of previous years.

Data from the national census are not directly used by the system, however they are somehow taken into account in the data from the LFS.

The administrator of the system, the RCSS, obtains the data from GUS in an electronic form. Later the data are transported to the database in the system.

**Question 9: What is the output of the forecast?**

The output of the forecast depends on its subject. But the general principle is the following: the variable of time and the variable the forecast concerned. While preparing projections of demand in certain occupations (or rather groups of occupations: major, submajor and minor) we use the same code system (digits) as ISCO.

There are no combined arrays within the system – such forecasts can only be carried out using the ZBSE method (no longer exists). In 1999 a forecast until 2005 was prepared – it comprises 360 occupations x 5 levels of education x 5 (50) sectors of economy.

Results for one breakdown i.e. regions are presented in a table consisting of 16 rows x forecast period (5 years), by education (6 levels x period), occupations (10 major groups x period, 30 submajor groups x period, selected minor groups x period).

**Question 10: What is the period of the forecast?**

The standard forecasting period is five years. However, in connection with preparing the national development plan 2007-13, a projection until 2013 has also been made.

**Question 11: How often is the forecast repeated?**

The frequency of forecasting is not determined yet. In the initial period of functioning of the system the forecast is to be repeated twice a year (to make sure the system operates smoothly and without any disturbances). Thereafter, a global projection is to be prepared once a year.

Nevertheless – depending on needs – sectoral and more specific forecasts can be carried out on an ad hoc basis (in certain occupations or groups of occupations).

**Question 12: Are there procedures for the *ex post* evaluation of the quality of results of the forecast? How do you assess the quality (accuracy, reliability, robustness) of the output?**

The diagram of the forecast depicts the following values: actual values of the variable in the period the input data concern, the values of *ex post* forecasts for the reference period (these two overlay each other) and the values of the *ex ante* forecast for a given variable. It more or less allows estimation of the reliability and accuracy of forecasts.

*Ex post* evaluation is carried out twice:

(a) selecting forecast model we rely on the *ex post* error in the time of the sample (historic) – mean absolute percentage error;

(b) later, after carrying out the forecast (once or twice a year) we use the mean absolute percentage error again.

**Question 13: What is the use/target group of the forecast?**

The users/target group of forecasts are different. First, they are politicians and top decision-makers preparing policy documents in labour-market and education and training policy. Second, forecasts are designed for educational providers (those maintaining schools and education and training institutions) so they can adapt their offers to current and anticipated needs of the economy and labour market. Third, forecasts can and should be used by career guidance and counselling services; the system can constitute a useful tool for them to inform their clients (school pupils, students, the unemployed, people willing to retrain or acquire new qualifications) about professions and qualifications that will be in demand in the future.

**Question 14: Who does the forecast?**

The system is brand new and so far forecasts have been prepared by members of the intergovernmental task force for labour demand and academics from the chair of spatial econometrics at the University of Lodz (the system contractor). Employees of RCSS, Department of Social and Constitutional Affairs, where the system is based, have been trained and are entitled to prepare forecasts. In practical terms, a limited number of employees has access to the forecast module. For full utilisation of the possibilities of the system a series of training for civil servants has been organised. Training has to be enriched as in forecasting, combining various qualifications is needed – skills and experience in analytical work, projections and ICT.

**Question 15: Who pays for the forecasting work and the necessary data?**

RCSS – the administrator of the system of forecasting labour demand receives the necessary data from the GUS at no charge – as both the respective bodies are within governmental administration (civil service).

| Question 16: | What are your ideas for establishing a forecasting approach at European level? How should this activity be organised and cooperation arranged, who should be involved, should there be a platform (e.g. at Cedefop) for cooperation? |
|---|---|

The idea of establishing a forecasting approach at European level is worth discussing and considering, although a difficult and challenging task. Despite most European countries applying ISCO (from the perspective of the labour market), the systems of education and training (producing qualifications and skills) still differ substantially among them and it would be difficult to ensure the necessary comparability of qualification levels. However, at European level we may soon be equipped with a useful tool for comparison of qualifications, namely the European qualification framework.

A good introduction would be to initiate an international research project possibly within the framework programme. Such a project, involving partners from EU Member States, could develop common methodology and models of forecasting skill needs.

For quality of data input common data sources could be used, i.e. Eurostat data (e.g. LFS data) or UOE data.

Reliability and accuracy of output can be ensured by adopting common methodological frameworks, i.e. in terms of the layout of the output.

Means of cooperation: possibly open method of coordination.

An electronic platform (e.g. on Cedefop's website or the European training village) could be established – it could constitute a basis for communication and joint activities. On the website verified outputs of forecasts could be presented. Users, namely policy-makers and guidance practitioners could access the platform, although access would not be automatic, but granted upon request.

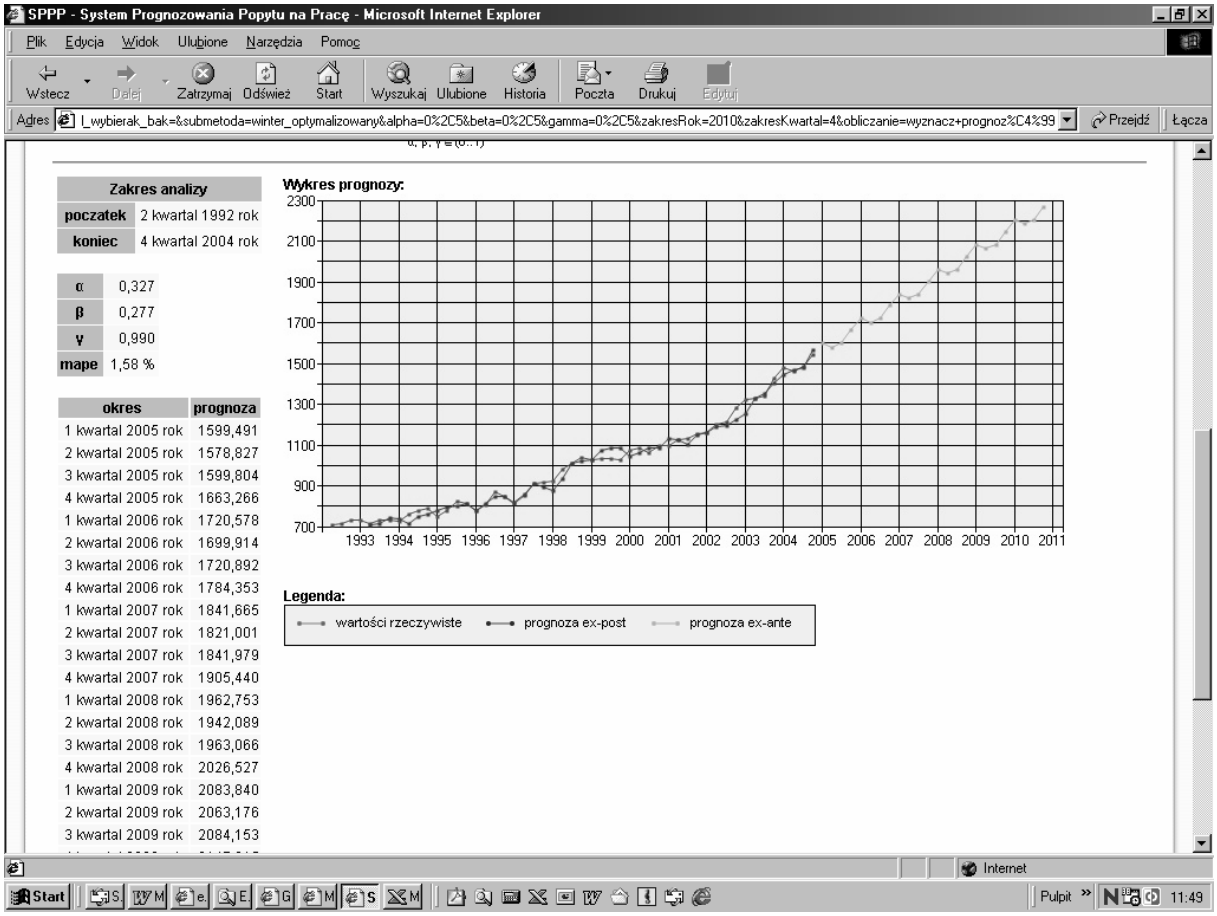
Bodies involved:

(a) at European level: Cedefop, European Commission and Eurostat;

(b) at national level: authorities dealing with forecasting labour demand (skill needs), where there is more than one such institution in a given country, one coordinating body should be appointed.

# Annex: Example of forecasts

Employed women with higher education – forecast till 2011.



# Romania

*Catalin Ghinararu; National Research Institute for Labour and Social Protection*

**Question 1: How are 'skills' defined in skill needs forecasting approaches in your country?**

Romania currently makes use of the term 'skill' in all its meanings and definitions, according to the practical use for which the term is employed. National statistics on education and forecasting exercises which have so far been undertaken for assessing demand for skills from the perspective of the vocational education and training system that operates under the auspices of the Ministry of Education, defines skills as an educational attainment in the same sense as ISCED. Thus, the most elaborate forecasting exercises so far attempted focus on this particular meaning of skills.

However, the system designed by the National Adult Training Board, in its capacity of National Qualification Authority, uses the term 'skills' in its sense of 'formal qualification' and respectively 'occupational skill', using the two following national classifications:

(a) classification of occupations, regularly updated under the auspices of the Ministry of Labour when proposals from various professional entities (employer's unions, professional associations, trade unions, companies, State authorities, etc.) are submitted;

(b) occupational standards, designed under the auspices of the National Council for Occupational Standards, until recently an autonomous entity, now operating under the same National Qualifications Authority and which draw their inspiration from the ISCO system.

The second meaning, which is related to 'fields or subjects of study', is only used inside the education system for purposes connected with elaboration of the curriculum, the structure of the education system and other related matters. Statistics are available for practically all the meanings with the sole mention that the ones on 'occupational skills' and 'formal qualifications' are scarce, somehow inconsistent and characterised by poor quality.

Skills forecasting in Romania is still in its nascent phase. As such, concepts are not fully clarified with the meaning of the term skills still ambiguously used. If the explorative approaches that have been employed have tended more or less to keep close to the meaning of 'occupational skills' or 'formal qualification', econometric approaches have tended to lean more towards the first meaning, which associates skills with an educational attainment, a variable which displays a higher degree of credibility when forecast due to its level of aggregation. The opposite goes for the other presumed variable, namely formal qualification or occupational skills, which retains a high degree of disaggregation and as such marks a net loss in its credibility when forecast by using econometric models.

Nevertheless, the most comprehensive exercise in skills forecasting undertaken to date, attempts to forecast skills in both their meanings, beginning with 'educational level', while further developing into its second and more disaggregated meaning of 'occupational skills' and 'formal qualification'. The econometric approach is duly complemented by an explorative approach which actually renders forecasting, with respect to the second meaning, possible.

**Question 2: Which main method is currently used for mid/long-term forecasting of skill needs at macroeconomic level in your country?**

The main method is an amalgamation of a statistical field investigation conducted among enterprises, use of classic production functions (Cobb-Douglas) and trend equations, all

consolidated by the partial use of the Macbeth model. This method has been developed in the National Labour Research Institute. It has only been applied for seven of Romania's eight development regions, thereby excluding the capital city of Bucharest. A second alternative method which does not necessarily forecast demand for skills, can also be used as a point of departure, as it forecasts, using consumer price index (CPI) set normative as main exogenous variable, the major labour-market aggregates (total employment, unemployment rate-ILO/LFS, average wage, minimum wage). It derives from a model called MITGEM, developed for macroeconomic and labour market forecasting purposes (general tool). As the first method specifically deals with forecasting demand for skills, we will go into more detail, with the second method receiving less attention as it can only be used as a background tool from which an alternative method for skills demand forecasting may eventually arise.

The first method consists of three major methodological blocks, each performing a specific function and using a distinctive methodological approach:

(a) a statistical field investigation block, that relies on a representative survey, substantiated by a questionnaire, applied on a representative sample of 2 400 companies, selected from seven of the country's eight development regions. The sample only includes companies currently having more than 10 employees. An additional, small-scale, non-representative survey relies on a sample of 244 enterprises with less than 10 employees. The survey aims to identify the potential for new job generation of the corporate sector. It covers only seven of Romania's eight development regions. The region of Bucharest (Bucharest-Ilfov development region) remains yet uncovered both by this block and the subsequent one, due to financial constraints. The survey is only carried on an ad hoc basis, with the National Labour Research Institute serving as depository of the database of companies. The data have been obtained from the National Office of the Commerce Register on a paid basis;

(b) the second block forecasts the supply side and uses as a background the forecasts of the National Institute of Statistics (INS). It makes use of simple trend equations and interpolates for years that are missing from the series provided by the INS. This input information is used to project evolutions of skills demand related variables such as: school-aged population, school enrolment and others with breakdowns on educational attainment as well as by broad fields of study;

(c) the third and main methodological block deals specifically with forecasting skills demand using three alternative approaches, which subsequently result in three major forecasting scenarios. The first simply relies on trend equations and as such extrapolates past trends into the future, assuming that past evolutions and trends will have a reasonable chance of continuing at least into the near future. This method leads to highly improbable results as it considers events and phenomena closely associated with the process of transition from plan to market and as such are virtually impossible to replicate in the future. The second method is a crude adaptation of the Macbeth model with the starting point in 2002, the year of the last population census. It makes use of foreign direct and domestic investments as exogenous variables. However, it seems that due to an inherent scarcity of data as well as due accumulated distortions in Romania's transition evolution, use of this variable, as recommended in the original model, does not lead to conclusive results. As such, GDP growth set normative in accordance with the targets contained in the national development plan 2007-13 is used as an exogenous variable. This second approach provides both for the forecast of expansion as well as for replacement demand. Finally, a third approach of the main method simply lowers the growth rates contained in the national development plan and thereby, as these rates are initially projected considering gains in labour productivity, assumes these gains will be lower and as such larger swathes of low-productivity employment

will likely persist for the forecasting interval (2005-13). Employment will witness a fluctuating evolution against the background of a continuously declining trend. In the end, the method works on a goal-setting mechanism that imposes a certain target for occupational structures modelled on a proposed economic structure and thus attempts to work out possible evolutions leading to the attainment of set targets.

The alternative approach proposed by the author of this paper, while not explicitly forecasting demands for skills, forecasts employment as a block labour-market aggregate, using inflation rate (CPI) as the main exogenous variable. It builds on the assumption that stability in the market-driven price-setting mechanism as expressed by the CPI acts as proxy for general economic stability and predictability, and indicates the degree to which a transition economy gradually turns into an emergent market one and eventually after a considerable period of time into a mature one. The lower and the less erratic the variations in prices as encapsulated by the CPI variations, the higher the predictability of an economy and thus the higher the growth rates as the more intense investment flows. Consequently, total employment converges over time towards the 'productivity determined employment' or towards a threshold that is fairly consistent with labour productivity. As such, the method only partially extrapolates past trends, building equations that use as a departure point, the year when a particular economy (i.e. Romania's in this case) has attained its critical mass of progress in transition or, in other words, the moment from which economic reform starts yielding tangible benefits for the mass of individuals and enterprises. By providing projections for two major aggregates, namely total employment and 'productivity-related/determined employment' as a benchmark against which evolutions in total employment can be assessed, this method provides a starting point for forecasting demand for skills, more adapted to the needs of a transition economy. In its support, its forecast of the growth rate for 2004 missed the real 2004 growth rate by only 0.8 percentage points, while the forecast of the National Forecasting Commission, which has been used for substantiating the national development plan (whose set growth targets are used in the first model) missed the same real growth rate by no less than 3.3 percentage points.

**Question 3: Which methods/models are used for the input information on macroeconomic forecasting and (sectoral) employment projections?**

The model/method that specifically addresses skills forecasting uses as its major input the population/demographic projections of the INS. Series for the exogenous variable (i.e. GDP growth) are derived from the productivity-based model of the National Forecast Commission, with the limitations and reliability concerns previously noted.

The representative enterprise survey provides a useful complement of output against which output from econometric model are subsequently assessed.

**Question 4: Does the skill needs forecasting method only include forecasts of total demand or also expansion demand and replacement demand?**

Both expansion and replacement demand are tackled by the approach employed for forecasting skills. Replacement demand is considered by forecasting the number of persons due to retire during the forecasting interval (2005-13). The estimate considers the probability for the cohorts corresponding to a certain age group and in the meantime an associated occupational skills group to reach a five-year higher age group, either inside the working age population or in the one above.

Replacement demand is also assessed by the alternative model of Dr. Ghinararu which estimates several variables associated with the pension system (number of pensioners, number of old

age pensioners, number of disability pensioners, number of survivor's pensioners) and thus projects the number of persons leaving the working age population and the labour market.

**Question 5: Does the method consider the supply side, and possibly interactions between supply and demand?**

Yes, the method or the amalgamation that resulted duly takes into consideration the supply side. Forecasts performed by the Romanian INS have been employed and as such incorporated into the method/model used for skills forecasting. All the major supply aggregates (total population, working age population, population by main age groups as well as school aged population) have been projected as such. They have been subsequently used to project school enrolment and the number of graduates by educational attainment as well as for each level of educational attainment by broad fields of study.

**Question 6: Does the approach also consider (exogenous) factors such as impact of technologies, work organisation, socioeconomic conditions globalisation/relocation of jobs, etc.?**

Major weakness of the first model/method is precisely the way in which it accounts for exogenous factors as its main explanatory variable and the source from which it is inserted into the model, have little reliability. The first model does not account for the impact of globalisation and takes technological change into account to a limited degree. It does not provide a benchmark against which to assess evolutions of employment and thus the goal-setting mechanism, on which it relies, loses considerably. Nevertheless, by applying different scenarios and departing from the alternative offered by the national development plan, precisely because gains in productivity are questionable, restores a considerable amount of credibility.

The second method, though not explicitly designed for forecasting the demand for skills, nevertheless provides a wide range of background aggregates and accounts for exogenous factors to a higher degree. By using CPI as main explanatory variable and by creating an productivity-related total employment as a theoretical measure acting as benchmark for the projections of real employment, it takes into account more the effect of potential exogenous shocks that usually filter via prices and the price-setting mechanism. Its main strength however relies in the way the forecasting scenarios are built, which is modelled around the critical mass of progress in transition moment and which, thereby, allows for a selective extrapolation of trends.

**Question 7: Which classifications are in use at different stages of forecasting?**

NACE (one-digit level) is used for the following indicators incorporated in the first method specifically designed for forecasting skills demand:

(a) number of registered firms;
(b) total turnover by activity;
(c) gross investment by activity;
(d) occupied population (total employment) by activity;
(e) occupied population (total employment) in industry by activity;
(f) average wage/salary by activity.

**Question 8: Data sources and quality**

**(a) Which data and data sources are used at different stages of forecasting?**
**(b) Please indicate the quality of data input.**
**(c) Please mention the minimum length of time series required where applicable.**
**(d) Please – in sample surveys – specify the sample, its representativeness, and the regularity/frequency of the survey.**
**(e) Where data come from the national census, please indicate its frequency and possible combination with other data sources.**
**(f) How do you organise access to these data?**

The following data sources have been employed:

- the LFS (Eurostat compatible methodology) undertaken by the INS;
- population and dwellings Census, undertaken by the INS;
- administrative data of the National Agency for Employment (NAE);
- records of the National Office of the Commerce Register;
- other data from specialised researches of the INS;
- own data provided by the enterprise survey undertaken jointly with the Center for Urban and Regional Sociology (CURS).

Minimum length of time series is eight years. Publicly available data had to be complemented by paid data from the INS. Data provided by the enterprise survey undertaken with CURS are of excellent quality and representative for the regions on which it has been applied. Nationwide representative character was hindered by the lack of the Bucharest-Ilfov region from the one-time research endeavour undertaken so far.

National census is performed by the INS once in 10 years. Nevertheless, between 1977 and 1992 no census was performed due to the communist regime ruling the country at the time. There is one over-10-years inter-census period. Methodology of the census differs from other investigations as such possibilities of combining while existing, have to be weighed with caution.

Database of the Commerce Register is also accessible only after paying a fee. Databases constructed by the INS are also accessible only on a paid basis. Data provided by the INS are partly free, in the sense that they are published regularly and publications are available for purchase by the wider public. Nevertheless, more in-depth information is not in the public domain and, therefore, additional payment is needed.

**Question 9: What is the output of the forecast?**

The forecast delivers output for seven of Romania's eight development regions, for 10 economic activities and 19 occupational skills groups. Only occupational skills that require VET education are considered. Occupational skills that require higher education are not part of the model/method.

**Question 10: What is the period of the forecast?**

The forecast period is 8-10 years.

**Question 11: How often is the forecast repeated?**

This forecast is not a regular one. It has been performed as a one-time research endeavour at the request of the Ministry of Education (the VET unit).

**Question 12: Are there procedures for the *ex post* evaluation of the quality of results of the forecast?**

In the case of trend extrapolation, residuals have been eliminated by smoothing the empirical series, for those observation units (judets) which have fallen outside the limits of the confidence intervals. For 'judets' where smoothing was not applicable, errors have been checked for autocorrelation and when this has been observed, it has been duly removed with smoothing applied subsequently.

**Question 13: What is the use/target group of the forecast?**

Currently output has been used for substantiating regional and local VET action plans. They also serve for decision-making support in the VET unit of the Ministry of Education, which has been the beneficiary of the project and sponsored its undertaking using EU-Phare programme.

**Question 14: Who does the forecast?**

Until now the forecast has been undertaken by the National Labour Research Institute, solely for the purposes of the Ministry of Education, the Phare-VET unit. The filed investigation (enterprise-survey) has been undertaken in cooperation with CURS, a polling institute.

**Question 15: Who pays for the forecasting work and the necessary data?**

The current forecasting endeavour has been entirely financed from EU-Phare funds.

**Question 16: What are your ideas for establishing a forecasting approach at European level? How should this activity be organised and cooperation arranged, who should be involved, should there be a platform (e.g. at Cedefop) for cooperation?**

Cedefop can and should act as a platform for cooperation, specialised training and expertise-sharing. Compatibility of data is useful but it would take a long while to be achieved. Availability of data is a problem as sometimes costs for purchasing information and for updating prevents performing the forecast regularly. Output can be of great use for a broad range of users not only in the government but also in the business sector. More should be done to publicise it and encourage methodological exchanges.

# United Kingdom

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## Introduction

This document provides a technical description of the sources and methods used to generate the set of occupational employment projections presented in *Working Futures 2004-2014* (Wilson et al., 2005). These projections for the UK were prepared by the Institute for Employment Research (IER) and Cambridge Econometrics on behalf of the Sector Skills Development Agency (SSDA). They update those produced in 2003 (Wilson et al., 2003). This document summarises the methodological approach employed to generate the projections which are the most detailed and comprehensive ever published in the UK. Other projections are also produced in the UK by, and on behalf of, a variety of organisations. These are too numerous to detail here, but generally adopt similar methods ([24]).

**Question 1: How are 'skills' defined in skill needs forecasting approaches in your country?**

The main ways that skills are usually defined in the UK are in terms of occupation or qualification. Both have the merit of being relatively straightforward to measure and readily understood. More recently there has been much greater emphasis on what are termed (variously) key, core and generic skills. These include things such as: literacy and numeracy; general management skills; communication and customer handling skills; information handling skills; and team working. These types of skill are frequently emphasised when employers are asked about their skill needs. Unfortunately these terms are nowhere near as well established as occupation and qualification, either in terms of a consensus about what they mean, or on how best to measure them. In most projections work undertaken in the UK the focus is upon the occupation measure, although from time to time emphasis has also been placed on the implications for the qualification structure of employment.

**Question 2: Which main method is currently used for mid/long-term forecasting of skill needs at macroeconomic level in your country?**

The demand for skills is derived from the demand for goods and services. For this reason the IER has always argued that labour-market projections should be firmly grounded on an understanding of how the economy as a whole is changing. Changes in employment structure and the need for skills are intimately tied up with the development of the economy more generally. This has been operationalised in the form of the regional multisectoral dynamic model (RMDM) of the economy developed by Cambridge Econometrics.

The macroeconomic model used is based on a detailed analysis of economic and other behavioural relationships, statistically estimated, using robust econometric methods. The current version of the model is based on a bottom-up treatment of regional economic prospects. The model offers a combination of great detail, and a high level of sophistication. The use of a fully-specified model has several advantages over ad hoc extrapolation methods for individual sectors. These include enforcement of logical and accounting constraints, development of a

([24]) For a more detailed discussion see Wilson et al. (2004).

consistent scenario across all sectors, and making explicit the underlying assumptions built into the projections. The importance of using such methods, and details of the approach are given in Barker and Peterson (1987) and Wilson (1994).

The macroeconomic model produces estimates and projections of employment by industry. Translating this into implications for skills (occupations or qualifications) is done using submodels that operate independently of the main macroeconomic model. The methods for projecting occupational employment change are based on less sophisticated procedures than for total employment. In theory, it would be desirable to develop a full model of supply and demand for different occupations, taking into account the various behavioural factors which may influence future developments. In practice, severe data limitations preclude such an ambitious approach. Throughout the world, most occupational employment forecasts are based on simplistic extrapolation of past trends (for a review see Wilson, 2001). The availability of time series data from the LFS has offered the possibility of a more sophisticated approach, based on econometric analysis of occupational shares (see Briscoe and Wilson, 2003). In practice, although this analysis offers some insight into the sensitivity of the projections to certain key economic indicators, the results suggest that underlying trends are dominated by technological and organisational shifts, which are best proxied by time trends. Moreover, extension to the more detailed sectoral and spatial level required in *Working Futures*, is not possible due to data limitations. The *Working Futures* projections are, therefore, based on a conventional approach, involving extrapolation of historical changes at a detailed level.

The approach to projecting occupational employment structure, therefore, involves two stages. First, projections of the likely changes in industrial employment (by region) are made using RMDM. Second, projections of the occupational structure of employment within each industry are made using data from the censuses of population (the results now take full account of data from the 2001 census). Occupation by industry employment share (SIC-SOC) matrices are extrapolated. The projected occupational shares in each industry are then applied to the industry forecasts from RMDM to obtain projected levels of employment. The occupational projections are, therefore, based on a submodel which takes as input the regional/industrial employment projections produced by RMDM.

This is done at a considerable level of detail. Around 70 industries are defined, cross classified by 6 gender/status categories, 25 occupational groups and around 60 geographical areas. This means that well over half a million separate time series are projected. Projections of occupational shares at this level of detail place considerable demands on the data available and the situation on the ground can be changed rapidly and substantially by technological and other changes. It is important to appreciate the assumptions used and the range of factors which it is felt are likely to influence immediate future trends, including, how these may diverge from previous patterns of change.

The overall changes in aggregate occupational structure arise through a combination of shifting patterns of industrial employment structure and the changing occupational composition of employment within industries. The former can be regarded as primarily a reflection of the way in which the changing pattern of demands for commodities by consumers and companies impinges on occupational structure, while the latter is more a reflection of technological and organisational changes affecting the manner in which goods and services are provided. The level of employment in a particular occupation can, therefore, change for two main reasons; either because the industries in which it is concentrated grow or decline, or because of changes in occupational composition within industries. The former is termed the industrial effect, the latter the occupational effect.

The so-called occupational effect may arise for several reasons. Medium-term developments in technology may affect the structure of demand for certain skills. Demand may also change in response to changes in the relative rates of pay associated with certain trades, which may in turn be affected by the supply side of the labour market. In the short term the level of employment in each industry may depend upon the cyclical position in which it finds itself. Certain skills may be regarded as fixed rather than variable inputs in the production process for technological reasons. Further, it is apparent that the costs of hiring and firing (that is costs associated with changing the level of employment) differ considerably between different occupations. Finally, the actual levels of employment observed at any particular time will reflect the balance of supply and demand; shortages for certain skills may result in divergence from the long-run structure of employment desired by firms. This again will be dependent upon current rates of pay, the scope for substitution of one skill for another in the production process, and the flexibility of wages.

In the absence of a formal econometric model encapsulating these behavioural influences, they are built into the projections in a more ad hoc fashion, using professional judgement based on a reading of the most important current developments. A particularly important element here is the use of data from recent LFS. However, various other sources are also used, including some more qualitative data. This information is used to calibrate the occupational model over the recent past and to modify the projections. The LFS data are used to make an estimate of occupational structure in the base year. This is then compared with that emerging from the occupational model. The results of this exercise are used to modify the projected changes in the light of recent and current developments in occupational structure that may not reflect a simple continuation of long-term trends in the 1980s and 1990s. The results should be regarded as indicative of general trends and not precise forecasts of what will happen in particular cases.

Projections by qualifications are produced using similar submodels but linked to occupational employment rather than sectoral or industrial employment. The qualification models also include a treatment of supply (Wilson and Bosworth, 2006).

**Question 3: Which methods/models are used for the input information on macroeconomic forecasting and (sectoral) employment projections?**

RMDM has a Keynesian structure incorporating a detailed input-output system and concentrates on the determination of changes in the real sector of the economy. Moreover each region is modelled separately, with UK results being obtained by summation. At its heart is an input-output matrix, which deals with the flows of goods and services between industries and determines total industrial outputs. These equations are all solved together so that the final results are consistent with the various identities required by the national accounts. There are currently 41 main employing activities distinguished. These categories are based on the limitations of data available from the input-output tables. The level of disaggregation of commodities and industries is considerable. RMDM comprises over 5 000 behavioural and technical relationships (excluding accounting identities). Its main components are equations explaining consumption, investment, employment and prices. It also includes equations for average earnings by industry and region. Other aspects of the supply side come in through the export and import equations, in which capacity utilisation affects trade performance. The set of employment equations allow relative wage rates and interest rates to affect employment and, therefore, industry-level productivity growth.

The relationship between industry employment and industry output is based on an error-correction formulation, where the residuals from the first-stage cointegrating regression, (which represents the long-run relationship between employment and its determinants) are used in a

second-stage dynamic specification, which incorporates various lagged terms to reflect adjustment lags (e.g. Briscoe and Wilson, 1991). The inclusion of the residuals from the first stage ensures that the long-run solution, given by the cointegrating regression, is imposed. To complement the employment equations, a set of hours equations by industry are estimated, which relate average weekly hours worked by industry to normal hours and capacity utilisation.

The macroeconomic model is, generally speaking, based on quite sophisticated econometric analysis of long-time series data sets. It is characterised by many feedbacks from one set of equations to another. By contrast, the other submodels relating to occupational employment and replacement demands are based on much more limited data and do not feed back into the main macroeconomic model. This includes the models used to develop projections of occupational structure and qualifications.

The projections also involve further more ad hoc procedures, which allow for even greater detail. These include:

(a) extension from 41 to 67 sectors;

(b) development of results for the newly formed Sector Skills Councils;

(c) development of results for all 47 local Learning and Skills Council (LSC) areas within England, as well as the other countries and regions of the UK.

The model has a clear economic structure allowing incorporation of incomplete and partial data in a similar manner to the procedure followed in general equilibrium modelling, but at the same time validating the model's projections against the available data for employment and output. RMDM is a development of the Cambridge multisectoral dynamic model (MDM) of the UK economy. Barker and Peterson (1987) provide an account of version 6 of the model and Barker et al. (2001) provide a recent account of the RMDM.

**Question 4: Does the skill needs forecasting method only include forecasts of total demand or also expansion demand and replacement demand?**

Estimates of replacement demands have been a key feature of IER occupational projections for many years. Net changes in occupational employment (or expansion demand as they are often referred to) are only one indicator of future changes in the pattern of demand for skills. Education and training requirements are not simply dependent on which occupations are growing rapidly. There will also be many job openings and important education and training requirements for occupations where employment levels are expected to fall. These arise because of the need to replace the existing skills that will be lost as a result of retirements and other aspects of the normal process of labour turnover. These are referred to as replacement demands. The scale of replacement demand typically outstrips the scale of expansion demand, in the present projections by a factor of around 10 to 1. This varies across occupations and sectors but, even where substantial job losses are projected, the replacement demand elements are usually more than sufficient to offset this.

While the concept of replacement demand is simple enough to grasp, estimating it is a rather different matter. The main problem is that official statistics place much more emphasis on measuring stocks of people in particular States rather than flows from one State to another. Yet it is measurement of such flows which is essential to estimating replacement demands. However, use can be made of readily available statistics to provide indicative estimates. Ideally, a full set of demographic accounts which trace people's movement from one socioeconomic position (e.g. employment in a particular occupation) to another (e.g. retirement) are required. In practice, such a complete set of accounts does not exist even at national level. However, the

LFS now provides a sufficiently large sample to obtain rough estimates of the main elements at national level. The key components are:

(a) age structure – many of the flows, especially retirements and mortality, are age specific;

(b) retirement rates – these vary by gender and by age;

(c) mortality – another potential outflow, varying by age and gender;

(d) occupational mobility – another important source of loss for some occupations.

**Question 5: Does the method consider the supply side, and possibly interactions between supply and demand?**

Measuring the overall supply of people is relatively straightforward. Good data exist on demographics and (from the LFS) on those who are economically active (the labour force). The overall supply of people holding formal qualifications is also relatively straightforward to conceptualise and model. However, there are considerable difficulties in extending this to cover other dimensions such as occupation and sector. Most occupations are undertaken by people with a bewildering range of formal qualifications. This is partly a function of age, older workers often rely more upon experience than formal qualifications. However, even allowing for the age factor, there are enormous differences. This makes defining the supply of people into an occupation almost impossible. Some key elements can be identified, focusing on the flows of people through the education and training system, but boundaries are too blurred and transitory to enable quantitative modelling.

Much the same is true for the concept of supply of labour to a sector. This will depend upon the occupational mix of the sector and its geographical location. For some occupations the labour market may be worldwide. This is increasingly true of many high level managerial and professional groups. Ever increasing ease of transport now means that it is also a feature of the labour markets for many lower-level occupations (for example, construction and agricultural workers as well as nurses). While individual sectors may be able to address these issues it is very difficult to develop a general analysis that covers all this.

The concept of supply at a spatial level is somewhat more manageable. It is relatively straightforward to develop quantitative estimates and projections of population and the labour force for each geographical area. In principle, this can be extended to cover formal qualifications held. However, the data available here are much less robust than at national (UK) level. Moreover, commuting and migration flows become much more significant.

In *Working Futures* the treatment of labour supply is, therefore, much more limited than the treatment of employment. A new set of stochastic equations to forecast economic activity rates by region and age-band/gender has been estimated and incorporated into RMDM. The specification of the equations draws upon earlier work that IER undertook on behalf of Department for education and employment (Briscoe and Wilson, 1992) which underlies the systems currently used by Department for education and skills to construct the official UK projections of economic activity rates published in Labour market trends (25). The remainder of the model required to construct the projections of labour supply indicators consists of several accounting equations to derive labour supply and unemployment from the existing labour market and demographic projections in MDM.

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([25]) The most recent official projections were published in 1998 (*Labour market trends*, June, p. 281-297). ONS states that revised UK projections were published in 2005; it is not known when updated regional projections will be published.

A further model is used to develop projections of the numbers of those with different qualifications, distinguishing six broad national qualification framework (NQF) levels.

**Question 6: Does the approach also consider (exogenous) factors such as impact of technologies, work organisation, socioeconomic conditions globalisation/relocation of jobs, etc.?**

The main exogenous variables of the macroeconomic model are as follows:

(a) world growth in GDP;

(b) world inflation in GDP deflators and in prices of traded goods such as crude oil;

(c) UK population, labour force and natural resources (coal, oil and natural gas);

(d) current and capital spending of the UK government;

(e) UK tax rates and allowances;

(f) the sterling-dollar and other exchange rates;

(g) UK and US interest rates.

Technology is represented in a number of parts of the macroeconomic model, as well as in a number of the employment submodels, by time trends. In some cases, such as the input output elements, expert judgement is used to modify these extrapolations in the projections. Technology is also a key driver of changing occupational pattern within industries. As noted in Question 2 these are proxied by time trends/extrapolative methods.

**Question 7: Which classifications are in use at different stages of forecasting?**

*National accounts:*

The European system of (national) accounts (ESA95) is used to classify all the economic indicators used in the model. This has made redundant several commonly used terms and conventions. The output measure of GDP value added at factor cost (i.e. excluding all taxes and subsidies on production) is no longer part of the system. The concept is replaced by value added at basic prices, which excludes taxes like excise duties, but not taxes like business rates that are not attributable per unit sold. Hence, the 'headline' measure of GDP becomes GDP at market prices (including all taxes less subsidies), while the key concept for industry analysis is GVA (gross value added) at basic prices.

*Standard industrial classification (SIC):*

Industrial activity is classified using the SIC 1992 (2003). This is compatible with international systems.

*Standard occupational classification (SOC):*

The present analysis of occupational employment is based on the use of the SOC 2000. This is compatible with ISCO. Projections are typically developed for the 25 (two-digit level) submajor groups.

*National qualifications framework (NQF):*

Qualifications are now classified using the NQF. This has six main levels (ranging from no formal qualifications (NQF0) to postgraduate level (NQF5). It is broadly consistent with ISCED.

**Question 8: Data sources and quality**

**(a) Which data and data sources are used at different stages of forecasting?**
**(b) Please indicate the quality of data input.**
**(c) Please mention the minimum length of time series required where applicable.**
**(d) Please – in sample surveys – specify the sample, its representativeness, and the regularity/frequency of the survey.**
**(e) Where data come from the national census, please indicate its frequency and possible combination with other data sources.**
**(f) How do you organise access to these data?**

The models are based on a variety of official data sets. The ONS is responsible for most of the economic and labour-market statistics upon which this analysis is based. ONS is responsible for most of the key economic statistics upon which RMDM is based, including the UK national accounts and the input-output tables. This includes indicators such as: output and related indicators; wages and prices; trade statistics; UK balance of payments; and regional accounts. ONS/GAD also publish detailed demographic data including projections. These cover gender and single age groups.

ONS is also responsible for the annual business inquiry. As well as providing information on output, this is the most important source of information on industry employment levels. It provides detailed employment data by sector by gender and status. The data refer to mid-year levels. ONS also undertakes the regular LFS, as well as the more infrequent decennial census of population. These provide data on key aspects of employment structure such as occupation, self employment (which are not covered by the annual business inquiry), and data on the various flows and age structure needed for the replacement demand estimates. Because of the infrequent nature of the census of population and the small sample size of the LFS, such estimates are much less robust.

Estimates from the LFS and census of population are combined with industry employment data (distinguishing gender and status), to develop a comprehensive set of estimates. These are in the form of detailed industry (SIC) occupation (SOC) matrices. All available published official data on employment have been used. The data within the models and database are constrained to match headline estimates from the official sources (e.g. as published by ONS in *Labour market trends* and similar publications). This is achieved using so called RAS iterative methods ([26]).

([26]) The detailed employment data used in the projections can be conceived of in terms of multi-dimensional arrays with the following dimensions:

- industries (67 two-digit SIC categories);
- geographical areas (47 English local LSC areas plus the 3 other countries within the UK);
- occupations (25 sub major groups of SOC 2000);
- gender;
- status (full-time, part-time, self employment);
- time (years from 1981-2014).

ONS publish various headline statistics for certain aggregate elements of these arrays (typically sums across one or more dimensions). An iterative process, based on the so-called RAS procedure, is used to develop the detailed elements within the arrays in such a way that the various constraints are met. In two dimensions, a RAS procedure involves taking a two dimensional matrix of numbers and progressively and alternatively:

- forming row or column totals;
- calculating a ratio of these compared with some target values (typically provided by ONS figures);
- multiplying the rows or columns of the array by that ratio;
- re-summing and repeating the process.

Typically this process delivers a new array which matches the desired row and column totals within a comparatively few iterations (normally 20-30). In developing the database complex procedures have been developed which repeat this essentially simple process across all the dimensions above simultaneously, using constraints, which are, more often than not, incomplete.

Where there are inconsistencies between official sources, the industrial information (annual business inquiry based) is given precedence. Where no official data are published, estimates are generated by assuming common patterns to the next level of aggregation up at which official estimates are available. Occupational estimates and self employment estimates are based on the census of population and LFS.

The 2003 UK national accounts provide a key input into the macroeconomic model. An input-output table for 2001 in basic prices is estimated from official data to provide the detail needed to model inter-industry purchases and sales. Associated classification converters have been constructed using the available ONS data. These data are generally compatible with the European System of (National) Accounts (ESA95). Investment data are published at a much reduced level of detail. In the ESA95 household final consumption expenditure is classified by 51 categories of purpose. Historical data published in detail in the UK national accounts and consumer trends have been incorporated into the model. The latest data from the ONS for exports and imports are also incorporated into the model.

**Question 9: What is the output of the forecast?**

The full results of the *Working futures* projections are presented in a set of five reports:

(a) a national report for the whole of the UK, which describes the key employment trends and findings from the analysis. It includes detailed results by occupation and industry;

(b) a sectoral report, which provides information on key trends and prospects for each of the newly established 24 Sector Skills Councils;

(c) a spatial report, which presents projections for the individual countries and regions within England that together make up the UK and some sub regional areas.;

(d) a qualifications report which presents implications for the qualification structure of employment and likely developments in the numbers of those qualified;

(e) a technical report, which provides comprehensive details of sources and methods.

Detailed employment estimates and projections are produced by the following main dimensions:

- sector up to 67 two- three-digit categories of SIC 1992 (2003);
- occupation, typically two-digit categories of SOC 2000;
- gender;
- employment status (full-time, part-time and self employment);
- spatial (12 countries and regions and, within England, 47 local LSC areas).

In addition, more limited results are produced distinguishing qualification (typically six NQF levels) but this is not cross-classified by all the other dimensions simultaneously.

The main emphasis is on employment. Sectoral output is also projected. For occupations and qualifications, replacement demands are also estimated.

**Question 10: What is the period of the forecast?**

The historical data for employment cover the period 1981-2004, although some data sets extend even further back in time (especially within MDM).

The projections cover the period 2004-14. This has since been extended 2020 as part of the Leitch Review.

**Question 11: How often is the forecast repeated?**

The National skills task force recommended that this kind of exercise be repeated at least every two years. At some times the frequency has been annual. Although this is costly, for credibility it is important that the projections are seen to take account the latest data and events.

**Question 12: Are there procedures for the *ex post* evaluation of the quality of results of the forecast?**

The models and results from this kind of work are continuously being reviewed and reassessed in the light of new information. Formal evaluation is a time consuming and expensive task. The department for education and skills commissioned a review of previous projections in 2001 (Wilson et al., 2001). This highlighted the complex conceptual, as well as practical, problems in conducting a formal evaluation. A major problem is that much social science forecasting is intended to influence behaviour. The fact that events turn out differently from the projection may, therefore, be a desirable outcome. A second problem is that, unlike a simple random sample survey, establishing statistical confidence levels for this kind of projection is all but impossible.

The employment estimates make use of a wide variety of sources, as described above. As a consequence, it is not possible to calculate precise margins of error. From an analysis of previous projections it is clear that these margins can be quite large. Industry employment levels are typically projected within ±10 % over a 5-10 year horizon. The directions of change are projected correctly in around 90 % of cases. The errors in terms of annual percentage growth rates are usually of the same order of magnitude as the observed changes. Occupational employment levels are typically projected with ±7 % over a 5-10 year horizon. The direction of change is correctly projected in about 80 % of all cases. Occupational shares are usually projected within ±2 percentage points. (The typical share is around 4 percentage points). However, it is historical revisions to the data which account for a very large part of the forecast errors.

It is important to appreciate that the purpose of most projections of this kind is not to make precise forecasts of employment levels. Rather, the aim is to provide policy analysts and others with useful information about the general nature of changing employment patterns and their implications for skill requirements. The results are intended to provide a useful benchmark for debate and policy deliberations about underlying employment trends. However, they should not be regarded as precise. Many years of international research have demonstrated that detailed manpower planning is not a practicable proposition. The results should be regarded as indicative of general trends and orders of magnitude, given the assumptions adopted, rather than precise forecasts of what will necessarily happen (for further discussion see Wilson and Briscoe, 2002).

**Question 13: What is the use/target group of the forecast?**

The key target audience is the policy community involved in making decisions about education and training needs and provision. This includes:

(a) the SSDA and the Sector Skills Councils, who are charged with representing the views of employers;

(b) the Learning and Skills Council (and its local arms) who are involved in assessing needs and arranging provision;

(c) education and training providers;

(d) careers guidance organisations.

In addition the results are very widely disseminated and available to individuals making career choices and employers.

**Question 14: Who does the forecast?**

For many years the main national forecasting work has been put out to competitive open tender. With the exception of a brief two-year spell in the late 1980s, the IER (in collaboration with Cambridge Econometrics) has been successful in winning the contract to do this work (which it has done since the mid-1970s). Other forecasts are also produced by, and on behalf of, a variety of organisations but none of these are as comprehensive as those in *Working futures*.

**Question 15: Who pays for the forecasting work and the necessary data?**

The Government funds the work. Typically, the funding has been distributed via the Department for Education and Skills or its predecessors (Department for education and employment). Over the last three-four years funding for this kind of work has been channelled through the SSDA and the LSC.

Such detailed and sophisticated forecasting would not be feasible without a substantial investment in statistical infrastructure, including: national accounts; input output tables; the annual business inquiry; the LFS and the census of population. The scale of this investment is much larger than that involved in actually commissioning the projections. Of course, these data sources are used for many other purposes as well.

**Question 16: What are your ideas for establishing a forecasting approach at European level? How should this activity be organised and cooperation arranged, who should be involved, should there be a platform (e.g. at Cedefop) for cooperation?**

RMDM underwent a substantial programme of sectoral modelling development in 2004. The programme of work was drawn up to improve all of Cambridge Econometrics' sectoral-regional models (the European model E3ME, the global model E3MG and the UK model RMDM) and implemented changes required to make the models consistent with the most recent data and methods. The new industry classification is common to all the Cambridge Econometrics sectoral-regional models (E3ME, E3MG and the UK MDM) and so has improved the procedures for making international comparisons and consistency checks. In combination with data from the European LFS, this provides the potential to develop consistent projections across a large number of the countries in Europe.

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# Part III

# Towards European skill needs forecasting: summary and conclusions

# Summary of information input from Member States

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## Introduction

This section summarises the information provided by experts in forecasting occupations and skills from 14 European countries (the Czech Republic, Germany, Estonia, Ireland, Greece, France, Italy, Cyprus, the Netherlands, Austria, Poland, Romania, Finland and the United Kingdom) on their approaches to forecasting skill needs. It is based on the reports submitted to the workshop in Pafos (Cyprus) on 20 and 21 October 2005 and reviews the situation in Europe focusing mainly on concepts, methods, models, data sources and classifications in use.

## The concept of 'skills' in forecasting approaches

The definition of 'skills' in skill needs forecasting is not uniform among European countries. Countries can be grouped according to the emphasis they put on various meanings or notions of 'skills'. In several countries 'skills' are defined using both occupational skills and educational attainment (Ireland, France, the Netherlands, Austria, Poland, Finland and Romania). This is the most common and most inclusive definition. The UK, besides this widespread definition, also uses the term 'qualifications' and is trying to build on the generic skills concept (including social and personal skills), although this is still to be developed. In fact, the UK introduced the term 'skills' to the European agenda. Greece also applies diverse skills concepts, covering generic, technical and personal skills. In Estonia, Italy and Cyprus, skills are defined mainly in terms of occupations. However, in the Czech Republic and Germany more emphasis has been put on educational attainment/qualifications. Efforts to use ISCED as a basis have been made in several countries (e.g. the Czech Republic, Germany and Romania).

## Forecasting methods

Even though the main goals of forecasting are similar in all countries, methods applied in the Member States differ substantially. Most countries carry out one main forecasting study, with the exception of, Germany, Greece, France, Austria and Finland, where several forecasts are done independently or in parallel.

Changes in skill needs are closely connected to developments in the labour market as a whole, and are linked to major macroeconomic trends. Therefore, in most cases the methodology followed by countries suggests a several-step model, starting from macro modelling with a broad look over economic, labour market and sectoral development, and ending by focusing on demand for the whole range of occupations on the labour market. Some countries use a shift-share analysis (e.g. Ireland, Austria, the UK), others use time series extrapolation and other quantitative techniques.

As opposed to employment demand projections done by other countries, Germany has made a fundamental methodological decision not to focus on occupations. Instead, it is more focused on forecasting skills (qualifications), both for demand and supply of skills.

Forecasts are usually based on quantitative methodology. However, in many countries it is also combined with qualitative approaches. These are, to mention a few, experts' predictions (the Czech Republic), qualitative confrontations with sectoral studies (France), in-depth interviews

with persons from private and public sectors (Greece). These are carried out in parallel to econometric measuring.

In Greece, besides quantitative scenarios, an enterprise survey is also carried out. Particular emphasis in this research is put on examining skill mismatches, in addition to estimations of the needs of the labour force (by occupations).

Poland and Romania reported applying exclusively quantitative forecasting approaches, using a sophisticated econometric method. In Poland (besides macroeconomic and experts forecasts) a computerised integrated system of forecasting has been introduced, which allows application of several statistical methods of projections (namely, exponential smoothing, autoregressive model, equation models, etc.). Romania has also developed a statistically-based approach when carrying out its one-off forecasting study. It included combining three statistical models that lead to labour-market development scenarios.

## Macroeconomic (sectoral) input data and other data sources

Most countries apply a specific macroeconomic model. Forecasts of GDP growth rate, projections on value added for the whole economy and separate indicators in particular are part of it. Employment forecasts on general and sectoral levels are also usually carried out. Projections of demographic variables are taken into account in some countries. The Czech Republic and Germany do not use any formal and regular macroeconomic model, however, for different reasons: in the Czech Republic there have not been any regular macroeconomic forecasts carried out and available so far. Researchers use Hermin model and ad hoc experts' employment forecasts as additional corrective input. In Germany, however, it has been a methodological decision of researchers not to apply any formal macroeconomic model, as their reliability and validity in general is doubted.

For skill needs forecasting, LFS data are used extensively by Member States as well as data from the European system of national accounts (ESA95). Ireland uses additionally the quarterly national household survey. Some countries also use unemployment records or business inquiries. Besides these, data from the population census are applied, together with statistics obtained from national statistical offices and other sources, such as the Ministry of Education, Youth and Sport (the Czech Republic), Social Security Agency (Austria), Government Actuary Department (the UK), etc.

## Forecasting demand and supply

Although expansion demand is perceived to be the basic measure in employment forecasting, it is not the only source of changes in employment demand. Even if the number of workplaces for certain occupations does not grow or even if it decreases, there is still certain demand created by people leaving due to retirement, temporarily for maternity leave or for other reasons. In the vast majority of countries, both – expansion and replacement – demands are included in skill needs forecasting methods. For the remaining countries, Greece and Poland only forecast total demand, while in Ireland replacement demand measures are being implemented currently. Poland is also working on the inclusion of expansion and replacement demand in its systems.

Even if not always at the same level of precision, the supply side is taken into account by the majority of countries. The main parameter to predict is the inflow of school-leavers by the type of education/qualification, which in many studies is complemented with estimates of the amount of short-term unemployed ready to take up a job. This is then compared with job

openings for specialists with certain qualifications. (The forecast done by the Netherlands is a typical example of this model.)

Skill mismatches and shortages of specific qualifications are being estimated by comparing supply and demand. France and Ireland also carry out analysis at more general level, regarding trends in sectoral employment demand and thus looking for potential mismatches. None the less, not all countries consider interactions between supply and demand. Thus, Germany and Austria, for instance, carry out supply and demand studies independently. In Austria only a rough comparison is done, while in Germany no interaction is studied at all. In their view, the complexity of looking at supply as a factor of demand conditions renders this impossible.

Italy and the UK draw attention to major difficulties of supply estimates. Qualifications that people possess in a given occupation are so diverse that it is impossible for researchers to identify an indicative match of a certain qualification with a certain path in one's working life. Another trend is that younger workers have explicitly higher qualifications than older ones, and it is not possible to draw a straightforward conclusion whether this implies overqualification/ overeducation of the workforce or is related to ever-increasing demands for the abilities and skills to perform a particular job.

Supply forecasts are not yet being done in Cyprus and Poland. In Estonia supply is forecast only at very general level in the macroeconomic model.

## Considering exogenous factors

Almost all countries also take exogenous factors into account. Most country studies include the influence of, for example, national and international economic environments, economic growth, consumption demand, legal regulations, situation on the labour-market, salaries/wages, level of prices, etc. These are mainly considered with the help of quantitative measurements such as econometric equations (as in Greece, Italy and Poland).

Another way of including exogenous factors is extrapolating past labour-market trends for the coming years (as applied in Germany and Cyprus ). A qualitative approach, in particular, by experts' judgements on the impact of exogenous factors on the labour market, is applied (however, parallel to the quantitative one) in the Czech Republic, Germany, Estonia and the UK.

## Use of international classifications

Use of international classification systems is rather widespread in European countries. Only a minority uses classifications which are not compatible with international ones.

Economic sectors are classified either according to NACE, or to a national classification system. In Austria, Cyprus, Estonia, Germany, Italy, and Romania, sectoral classifications are based on NACE, whereas in Ireland, the Netherlands and Poland national classification systems are used, which are comparable to NACE. In the UK, industrial activity is classified using the standard industrial classification (SIC 2003) which is also compatible with NACE. In France, a national classification derived from NACE is used which is not compatible with any international classification at this level of aggregation.

Five countries use the ISCO occupational classification: the Czech Republic (2-digits), Estonia (broad groups), Greece (2 or 3-digits), Italy (2 to 4-digits), Cyprus (1 to 4-digits). Another four countries use their national systems which are compatible with ISCO: Ireland, the Netherlands, Poland and the UK. Austria is going to use ISCO in the coming years. However, almost all countries use different levels of aggregation (1, 2, 3 or 4-digits), although most of them apply

the 2 and/or more digits system. Germany and France have their own national occupational classifications which are not compatible with ISCO. In France, several occupational classifications are applied in different forecasts: FAP (*familles professionnelles*) is not compatible with ISCO. However, it was originally derived from *Repertoire operationnel des metiers et des emplois* (ROME) and *Professions et categories socioprofessionnelles* (PCS), both of which can roughly be compared to ISCO.

*Table 1: Overview of sectoral, occupational and skill classifications used in the countries (simplified)*

| Country | Sectoral classifications | Occupational classifications | Skill/educational classifications |
|---|---|---|---|
| Austria | NACE (2-digits) | ISCO (2-digits) in the near future | ISCED in the near future |
| Cyprus | NACE (2-digits) | ISCO (up to 4-digits) | n/a |
| Czech Republic | NACE | ISCO (2-digits) | ISCED (1-digit) |
| Estonia | NACE (2-digits) | ISCO (5 broad groups) | Classification not comparable with ISCED |
| Finland | NACE | ISCO | ISCED |
| France | Classification partially comparable with NACE | PCS (roughly comparable with ISCO) or FAP(not comparable with ISCO) | Classification comparable with ISCED |
| Germany | NACE (aggregated) | 22 occupational categories (not comparable with ISCO) | Formal qualifications (transferable to ISCED) |
| Greece | NACE | ISCO | Formal qualifications (transferable to ISCED) |
| Ireland | Classification comparable with NACE | Occupational classification (comparable with ISCO and SOC) | Indicative educational levels |
| Italy | NACE (2-digits) | ISCO (2 or 4-digits) | Formal national qualifications transferable to ISCED in the near future |
| Netherlands | Classification comparable with ISIC and NACE | Classification comparable with ISCO | Classification comparable with ISCED |
| Poland | Classification comparable with NACE | Classification comparable with ISCO | Classification not comparable with ISCED |
| Romania | NACE (1-digit) | Classification comparable with ISCO | Classification comparable with ISCED |
| United Kingdom | SIC (comparable with NACE) | SOC (comparable with ISCO) | NQF (broadly comparable with ISCED) |

The situation with educational classifications is less consistent and more problematic. France, the Netherlands and the UK apply national educational classifications which are (roughly) compatible with ISCED. The Czech Republic's forecasts are based on ISCED (1-digit) while the fields of study are coded by a unique national classification. Austria will apply ISCED 2-digits in forthcoming forecasts. In Germany, a national system is used, which is not directly compatible to ISCED, but transformation is regarded as possible. The Polish educational classification system has some links to ISCED, but does not correspond fully.

## The period and frequency of forecasting studies

Forecasts are carried out for a medium-term period of around five years in most countries (the Czech Republic, Greece, Ireland, Italy, the Netherlands, Poland). In Austria, there are three studies, covering periods of two to four, five, and eight years. The forecasts of Cyprus, France

and Romania cover a period of around 10 years, and in Estonia eight years. Apart from these, there are exceptions, such as Germany, Finland and the UK, where long-term forecasts are done for even up to a 30 year period. For example, in Germany it has been a deliberate decision not to make short-term forecasts.

Moreover, the frequency of forecasts varies among countries. It is related to the degree of establishment of forecasting in each Member State. So far, Estonia, Greece, Ireland, Italy, the Netherlands, Austria, Finland and the UK are carrying out their forecasts on a regular basis – annually or biannually. In France the forecasts are repeated every three to four years. In some other countries, however, the forecasts have not been carried out regularly so far. In these cases, countries plan to repeat the forecasts in future with different frequencies. This, however, is mostly dependent on the availability of financial resources (annually in Germany, biannually in the Czech Republic and Poland, and every five years in Cyprus). The Romanian forecasting study was a one-off project, and it is not yet being planned to repeat it.

## Producing output

The output of forecasts differs considerably among countries. It is obviously mainly related to the differing questions that each country seeks to answer with the help of forecasting. It is common to project overall and sectoral employment, although the number of sectors, and thus their division, is different in each country. Also a further breakdown of these projections by occupation does not follow the same pattern among countries. Matrixes and coefficients such as sector x occupation and occupation x education are calculated by almost all countries, although again with different levels of aggregation.

Apart from that, there are measures which are represented only in some countries' forecasts. These are, for example: number of pupils/students by type of schooling in Germany; gender in Ireland, the Netherlands and the UK; gender per occupation and/or education in the Czech Republic, Ireland and the Netherlands; shift-share analysis in the Czech Republic and Ireland. Larger countries also complement these projections with regional ones.

For different reasons, evaluating forecasts *ex post* is a fairly complicated matter. As some countries have argued, the value of forecasting is not to predict exact numbers, but more to indicate future trends, to raise awareness of possible difficulties, such as skills mismatches of demand and supply and to forecast potential labour force shortages in certain sectors or occupations.

## Discussions on evaluating the forecasts

It has been pointed out, that forecasting in social sciences might even aim at changing reality, based on its warning nature (e.g. the early warning that demand in a certain industry will grow rapidly and a shortage of adequately educated/trained individuals to fill the emerging vacancies is expected). If appropriate measures are taken to prevent this mismatch, the forecast will not become 'true'. Such a forecast alarm and subsequent reaction to increase the supply of educated/ trained people is welcomed. Thus, if an *ex post* evaluation indicates that such a shortage is not observed, it might mean that the warning function of the forecast was successful.

However, the majority of countries carry out some form of *ex post* evaluation. Predominantly it is comparison of the forecasting results with the actual data, when the period of the forecast has passed. Some other forms of evaluation in diverse countries include: sensitivity analysis, 'out-of-sample' forecast, mean absolute percentage error. These are done to assess how successful

and useful the forecast is or has been, as well as to improve the forecasting methodology to ensure the reliability and validity of the data obtained.

## Key audiences

Almost all countries recognise policy-makers/decision-makers as the main target group and users of forecasts. These usually include ministries, public employment services, employment agencies, etc. The difference is about the level to which the results are meant to be influential. While many countries recognise projections are meant to support policy-making, France, for example, emphasises that the findings can contribute to obtaining a holistic idea of developments in the labour market, but not directly for policy-making.

Also guidance and counselling services are often mentioned (e.g. in the Netherlands) as being target audiences, given their significance in informing people about their occupational or educational choices. The same is true for educational institutions, which are regarded as a target group in several countries. One of the target audiences in a few countries are individuals and the public in general (Cyprus, Finland and the UK), while, for example, in the Czech Republic forecasting results are not yet publicly available.

## Institutions involved in carrying out the studies

Forecasting studies are carried out in most countries by independent research institutes, or by local employment authorities (FÁS in Ireland, or Employment Observatory in Greece, the Planning Office in France). In some cases, it is a team of researchers in a relevant ministry (e.g. Ministry of Labour/Economy), or several ministries together (e.g. the Planning Office in France, that carries out the forecasts as part of their daily work. In these cases, when forecasting is not considered a separate project but rather a duty of the staff, it is not provided with additional/independent funding.

In most cases, none the less, forecasting studies undertaken by independent institutions are funded by the State – either by a relevant ministry, or by direct financing of the local employment authority. However, the funding allocated to forecasting projects is not stable and continuous in all countries which means that in some countries researchers still have to strive for funding on a one-off or project basis for each forecasting exercise.

Some research institutes have to pay for data. However in several countries researchers obtain statistical data from national statistics offices without any charge. It usually depends on who does the forecast and who is commissioning it.

## Comments and ideas for developing European skill needs forecasting

Countries acknowledge that it is difficult to create a common European forecasting system, mainly due to differences of data used and methods applied in European countries. Also the classifications of economic sectors, occupations and education do not correspond to one another in all countries concerned. However, at the same time many experts consider the European approach to be an important project to follow, given the positive effects that such a pan-European approach could have.

It became quite clear, based on experts' opinions, that the majority of countries still prefer national forecasting as a major way of projecting labour-market development and skill needs in their countries. The role of a common European approach is to provide additional and complementary information to national forecasts. It would serve for comparing and drawing conclusions on the current situations in the European labour market, constituted of national

markets. None the less, some countries have put forward a proposal entrusting the pan-European forecasting study to one or a few researchers/research groups, thus supporting a more coordinated approach (at least in the primary phase). The main idea behind this initiative is to improve the European approach as a voluntary one, complementing and enriching the view on future skill needs in Europe, but by no means aiming at diminishing the importance of national forecasts.

A crucial point for developing a common approach to European forecasting is agreement on classifications to be used. NACE, ISCO and ISCED are considered by several countries to be the classification systems that can possibly be used by all Member States. This expectation is supported by the current situation where already a considerable number of countries use these international classifications or others which are either based on or derived from, or can be easily adjusted to these. However, countries such as Germany and France partly use considerably different classification systems, which cannot be easily changed – and this change is not seen as a preference by these countries. However, in the meantime, France has started a pilot use of international classifications.

Concerning European data, the Eurostat LFS is regarded to be a useful source of data, as it is a unified survey all over the EU. There are also suggestions to establish ongoing cooperation among researchers (a network of researchers). Cedefop was asked to undertake the coordinating role and promote information exchange among participating researchers, through an electronic platform.

# Conclusions

*Olga Strietska-Ilina; Manfred Tessaring; Alena Zukersteinova; Cedefop*

The main aim of a European skill/occupational forecast is to provide the various actors and participants in the labour market, including policy-makers, with useful evidence of expected future labour-market developments and in particular of the skills and/or occupations that will be required in different economic sectors. Considering the free movement of labour in Europe, completing the single market, current demographic trends and other factors, the need for a tool which would forecast the future skill needs at European level is crucial.

The Cyprus workshop took the form of brainstorming session attended by experts in forecasting occupations, skills and/or educational fields from 13 Member States (the Czech Republic, Germany, Estonia, Greece, France, Ireland, Italy, Cyprus, the Netherlands, Austria, Poland, Finland and the UK) and one acceding country (Romania). All participants approved the idea of launching a European skill needs forecasting exercise and gave a clear message to Cedefop to continue with this initiative and coordinate further steps. It was proposed to proceed along two main paths.

In the short-term, a pan-European forecasting model should be devised which could be modified and refined in later stages. This pan-European forecast would develop macroeconomic projections and alternative scenarios for each Member State and aggregate the results to the EU-25 level. It will be broken down by economic sector, occupation and/or skill/qualification. It will cover the next five to 10 years and use comparative data for all Member States, such as the European LFS. However, there might be some limitations which have to be considered – for example, with LFS data the time series for some new Member States may be too short; other countries may be too small and thus their data at a disaggregated level may not be reliable. These and other problems and data gaps have to be identified during the work on the forecast and ways to overcome them should be found. It was agreed that ideally the forecast should include both the demand and supply sides to reveal skill mismatches on the European labour market. However, this would require availability of comparable data on labour supply. Therefore, it was decided to start with the demand side and to try to cover the supply side at a later stage.

In the longer-term, all European countries should be actively involved in the forecasting exercise. Agreements have to be reached to align the sources used at national level and make them consistent. Although there are considerable differences between countries in the objectives of forecasts, their methods and approaches, classifications, data sources, forecasting periods, organisations involved, etc., there are also many similarities between countries. Therefore, attempts to establish a European core forecasting system on occupational and skill needs – in agreement with all participating countries – appear useful. Whether occupations or skills/ qualifications, or both, should be the subject of this forecast will have to be decided. Some countries carry out occupational forecasts and group occupations by broad skill levels (based on ISCO 88); others use skills/qualifications according to their national definitions only, and still (a few) others combine occupations and skills. This system could be used and extended to all European countries, either as an additional/complementary system (in countries with more advanced forecasting methods) or as the main system (in countries where this activity has not yet been well developed).

It is necessary and important to reflect on the needs of Member States and to stress that this initiative does not affect the subsidiarity principle in any way. European skill needs forecasting will not replace existing national forecasting systems. It is a voluntary exercise and should only complement national forecasting systems. Participants also agreed that creating a pan-European skill needs forecasting system is a continuous process and will require the support and active engagement of everyone around the table.

Among necessary next steps, which were set during the workshop, Cedefop should discuss with the European Commission the question of support to the shorter-term initiative by approving financial and human resources needed for creating a proper European skill needs forecasting infrastructure and designing a 'pilot' forecast.

Participants called for the establishment of either a subnetwork in Skillsnet or a working group on this initiative with regular meetings. Cedefop should play an important role in initiating and facilitating the activities and disseminating the outcomes. Participants should have sufficient autonomy and ownership to make them willing to participate and take the results back to their own groups/networks. This subnetwork can also discuss the model to be used and define the conditions (including financial aspects) under which countries use and test the model. In the medium- or longer-term, the forecast should be extended with other methods (e.g. scenarios) and sectoral approaches.

Discussion also brought up the issue of organising meetings. Two types of meeting should be organised in future: meetings at which researchers can speak about their plans freely, and meetings which policy-makers attend to give feedback on plans, results, etc. Involving policy-makers in future is crucial for ensuring the relevance of forecasts for policy needs.

All participants agreed that this is a demanding task and a great deal of effort from all interested parties will be needed. Cedefop started on the short-term approach immediately after the workshop and first results are expected in the near future.

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# List of acronyms

| | | |
|---|---|---|
| AnCO | National Training and Employment Authority (until 1988) | IE |
| CBS | Statistics Netherlands [*Centraal Bureau voor de Statistiek*] | NL |
| CGE | Computable general equilibrium (model) | |
| CPB | Netherlands Bureau for Economic Policy Analysis | NL |
| CPI | Consumer price index | |
| CURS | Centre for Urban and Regional Sociology | RO |
| CWI | National employment agency [*Centrum voor werk en inkomen*] | NL |
| E3 | Energy-environment-economy | |
| E3ME | Energy-environment-economy model for Europe | |
| E3MG | Energy-environment-economy model at global level | |
| ECM | Error correction models | |
| EGFSN | Expert group on future skills needs | IE |
| ESRI | Economic and Social Research Institute | IE |
| ESYE | National statistical service | EL |
| EU | European Union | |
| FAP | *Familles professionnelles* | FR |
| FÁS | National Training and Employment Authority [*Foras Áiseanna Saothair*] | IE |
| Forfás | National policy and advisory board for enterprise, trade, science, technology and innovation | IE |
| GDP | Gross domestic product | |
| GUS | Central Statistical Office [*Główny Urząd Statystyczny*] | PL |
| HRD | Human resource development | |
| HRDA | Human Resource Development Authority | CY |
| IER | Institute for Employment Research (University of Warwick) | UK |
| IFO | Institute for Economic Research (University of Munich) | DE |

| | | |
|---|---|---|
| IHS | Institute for Advanced Studies | AT |
| ILO | International Labour Office | |
| INS | National Institute of Statistics [*Institutul Național de Statisică*] | RO |
| ISCED | International standard classification of education | |
| ISCO | International standard classification of occupations | |
| LFS | Labour force surveys | |
| MDM | Multisectoral dynamic model | |
| MEN | Ministry of Education [*Ministère de l'éducation nationale*] | FR |
| NACE | Statistical classification of economic activities in the EU [*Nomenclature statistique des Activités économiques dans la Communauté Européenne*] | |
| NQF | National qualification framework | UK |
| PCS | *Professions et catégories socioprofessionnelles* | FR |
| PMQ | *Prospective des métiers et qualifications* | FR |
| QNHS | Quarterly national households surveys | |
| R&D | Research and development | |
| RCSS | Governmental Centre for Strategic Studies | PL |
| RMDM | Regional multisectoral dynamic model | |
| ROA | Research Centre for Education and the Labour Market [*Researchcentrum voor Onderwijs en Arbeidsmarkt*] | NL |
| ROME | *Répertoire opérationnel des métiers et des emplois* | FR |
| RSE | Research scientists and engineers | |
| S&T | Science and technology | |
| SIC | Standard industrial classification | |
| SOC | Standard occupational classification | |
| Stakod 91 | Greek classification of the branches of economic activity | |

# Annex: Template

**Feasibility workshop on European skill needs forecasting**

**Pafos, Cyprus, 20-21 October 2005**

**Template for preparation of information inputs by Member States**

The information deficit about future skill needs in Europe has been experienced for a long time. The feasibility workshop will explore different approaches, data availability and compatibility of classifications in individual Member States with the view of achieving an agreement on the principle method of European skill needs forecasting.

This is a template for the preparation of papers and subsequent presentations in our feasibility workshop. We kindly ask all participants to follow the template accurately. Please address all questions provided below. For comparative reasons and for a more streamlined discussion at the workshop, it could be helpful if you follow the order of the questions in your answers. It may therefore be useful to read all questions before starting to fill in the template. Please try to avoid too lengthy explanations of methodological details, unless you consider them important. Please note that your paper should not focus on results of forecasting but on methods, models, data sources and classifications. The paper shall not exceed 5-10 pages. If necessary, you can include tables, figures and annexes, and make a reference to publications, working papers, websites, etc.

Please note that all papers will have to be drafted and distributed to participants prior to the event. The deadline for submission of papers is September 30, 2005.

1. How are **"skills"** defined in skill needs forecasting approaches in your country? Please define and specify.

> "Skills" in forecasting exercises may refer to "educational attainment" (e.g. ISCED classification), "formal qualification" (e.g. country-specific classification other than ISCED), "occupational skills" (e.g. based on ISCO or national occupational classification), "fields or subject of study" (in general education, vocational education and training, higher education), or related terms.

2. Which **main method** is currently used for mid/long-term forecasting of skill needs at macroeconomic level in your country? Please describe the method. In case if more than one forecasting method is in use in your country, please address all further questions separately for each of them.

3. Which (if any) methods/models are used for the input information on macroeconomic forecasting and (sectoral) employment projections?
4. Does the skill needs forecasting method include only forecasts of total demand or also of **expansion** demand and **replacement** demand?

5. Does the method take into account the **supply** side, and possibly interactions between supply and demand?

6. Does the approach also consider **(exogenous) factors** such as impact of technologies, work organisation, socio-economic conditions (such as consumer demand, legal and social regulations, quality, labour market situation), globalisation/relocation of jobs, etc.? If yes, in which way?

7. Which **classifications** are in use at different stages of forecasting? Please mention the corresponding international classifications where applicable (e.g. NACE, ISCO, ISCED etc. including the level by digits number) and refer to their compatibility. Please indicate also to which degree the national classifications used are compatible with the international ones.

8. Data sources and quality

   - Which **data and data sources** (e.g. labour force surveys, administrative records/registers, and the like) are in use at different stages of forecasting (macroeconomic forecasts, employment, demography, participation)? Please specify.

   - Please indicate the quality of data inputs.

   - Please mention the minimal length of time series required where applicable.

   - Please - in case of sample surveys - specify the sample, its representativeness, and the regularity/frequency of the survey.

   - Where the data come from the national census, please indicate its frequency and possibly combination with other data sources.

   - How do you organise access to these data?

9. What is the **output** of the forecast? Please describe the output at each stage of forecasting (e.g. number of sectors x occupations; number of occupations x educational or skills types etc.). Please explain the output typology (e.g. correspondence of occupations to ISCO – level by number of digits; reasons for special design of categories). In case of minimum cell size requirements, please specify.

10. What is the period of the forecast (e.g. projection for 5 years, 10 years)?

11. How often is the forecast **repeated**?

12. Are there procedures for the ex-post **evaluation** of the quality of results of the forecast? How do you assess the quality (accuracy, reliability, robustness) of the output?

13. What is **the use/target group** of the forecast (e.g. counselling and guidance/ policy making, etc.)?

14. Who **does** the forecast?

15. Who **pays** for the forecasting work and the necessary data?

16. What are your ideas for establishing a forecasting approach at European level? For example: How to ensure comparability between countries, quality of data input, relevance and feasibility of methods, reliability and accuracy of output, utility for users, e.g. policy makers, guidance? How should this activity be organised and cooperation arranged, who should be involved, should there be a platform (e.g. at Cedefop) for cooperation?

Cedefop (European Centre for the Development of Vocational Training)

**Towards European skill needs forecasting**

*Alena Zukersteinova*
*Olga Strietska-Ilina*
*(eds)*

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Information on future skill needs in Europe has been lacking for a long time. Finding ways of obtaining this information at European level is a main concern. Forecasting skill needs and demand at macro level has a number of limitations (e.g. reliability and level of detail of output, lack of information on skills gaps and competence requirements in the workplace, etc.). However, due to relatively low costs, if based on a common methodology and standardised statistics, (econometric) skill forecasting at European level could be feasible in the near future and could become an important information contribution for evidence-based policies.

The publication is based on the proceedings of an expert workshop held in Cyprus in October 2005 and presents potential opportunities and obstacles for European skill needs forecasting. The publication looks at feasibility of the common approach and summarises previous efforts to create pan-European skills forecasts as well as classifications, data and models essential for European skill needs forecasting. It presents the information input on methods, models, data sources and classifications of forecasting approaches at national level provided by Member States according to Cedefop's template.

More information can be found at www.trainingvillage.gr/skillsnet (under the 'Forecasting' section).

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PANORAMA

# Towards European skill needs forecasting

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