

Forecasting skill requirements at national and company levels
Robert A. Wilson

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Forecasting skill requirements at national and company levels

Rob A. Wilson

Abstract

The document reviews recent work on demand and supply forecasts at national level, broken down by sector, occupation and qualification, covering both European and other countries. This includes an assessment of forecasting approaches and results at regional and local levels. A review of the methods used and the results obtained at company level is also presented.

Labour market forecasts can be seen as having two prime roles: first to guide policy decisions made by the government and its representatives; and second, as a general aid to the individual actors operating within the labour market, providing them with information which can aid their own decision making. The fact that considerable efforts to conduct such forecast are going on all over the world suggests that, on balance, such activities are regarded as very useful and worth substantial investment by the public sector.

It is concluded, therefore, that forecasting of the labour market is inevitable. The only real question, is how this should be done. There appear to be two main possibilities:

- a) centrally, in a transparent, logical, consistent and systematic fashion, recognising the 'public good' aspects of such work;*
- b) or in a decentralised, often ad hoc fashion, by individual actors or groups, frequently based on implicit rather than explicit assumptions.*

A number of different approaches have been adopted to anticipate changing skill needs. The traditional approach has usually involved formal, quantitative methods, focusing mainly on occupations. More recently, other, rather less formal methods have been developed which have a strong qualitative emphasis. However, many exercises nowadays involve a mixture of both quantitative and qualitative methods, which are regarded as complementary. Increasingly, the focus is moving away from occupations to consider more general aspects of skill requirements.

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Summary¹

In the first Cedefop report, Tessaring (1998) reviewed a number of quantitative forecasts of employment by sector, occupation and qualification for several European countries. This included Denmark, Finland, France, Germany, Ireland, the Netherlands and the UK. A prime objective of the current work is to update this review, focusing on new methods, approaches and results and extending the coverage to additional countries. As well as examining practice in Europe, the review also covers recent work conducted in a number of non-European countries, including the USA, Canada and Australia.

The paper focuses on the issue of 'forecasting skills and requirements at national and company levels'. It begins with a review of recent work on demand and supply forecasts at national level, broken down by sector, occupation and qualification, covering both European and other countries. This includes an assessment of forecasting approaches and results at regional and local levels. It provides a comprehensive review of the different methods used and an assessment of their advantages and disadvantages. This includes the recent emphasis on changing generic skill requirements and the use of qualitative methodologies, as well as more traditional quantitative model-based approaches which focus on occupations. A review of the methods used and the results obtained at company level is also presented.

An eclectic methodological approach has been followed in undertaking this review, involv-

ing a range of techniques to locate relevant research being conducted in this area. This included a traditional literature search, a computerised literature search using digital databases including the internet and the use of various network contacts including Cedefop itself. A comprehensive bibliography of recent research throughout the Community and beyond has been produced.

The key hypotheses addressed are twofold:

- a) first, is labour market forecasting necessary?
- b) and second, if the answer to this question is yes, how should they be conducted?

Both the criticisms of forecasting and the counter arguments of its proponents are reviewed in detail.

There is a small, but at times vociferous, group of critics who have decried the value of such activities. They argue, variously, that it is unnecessary, impossible and /or irrelevant. It is argued in the review that most of these criticisms are misguided. In many cases, the criticisms have been constructive and have led directly to improvements in methods and approaches used, including the development of more qualitative methods. In other cases the practitioners involved in making projections have argued, convincingly in the opinion of the present author, that the criticisms are invalid.

There is a much larger body of opinion, therefore, that such forecasts can be of value to a broad range of potential users within a particular geographical area, be it a national economy or a much smaller local area. A strong case can be made that the provision of such projections can be regarded as a valuable *public good*, which should therefore be supported by central government. Labour market forecasts can be seen as having two prime roles: first to guide policy decisions made by the government and its representatives; and second, as a general aid to the individual actors operating within the labour market, providing them with information which can aid their own decision making.

¹ The author is indebted to a number of people who have assisted in this review. The bibliographies in Spanish, Italian and German draw upon the work of a Leonardo project organised by CESOS in Rome. The author is grateful to various colleagues from these countries for provision of this bibliographical material, including Michèle Blin, Jürgen Schultze, Antonio Vergani and Juan Antonio. Geoff Briscoe also made a number of important contributions, especially Section 4, while Barbara Wilson provided invaluable assistance in word processing. The author alone bears responsibility for the opinions expressed and any remaining errors.

Employers, education and training providers and, of course, individual students and workers themselves, all have an interest in trying to peer into the future in order to try to anticipate what may occur and to ensure that their own decisions result in the best possible outcomes (however these might be defined). The fact that considerable efforts to conduct such forecast are going on all over the world suggests that, on balance, such activities are regarded as very useful and worth substantial investment by the public sector.

It is concluded, therefore, that forecasting of the labour market is inevitable. The only real question, is how this should be done. There appear to be two main possibilities:

- a) formally, in a transparent, logical, consistent and systematic fashion, recognising the 'public good' aspects of such work (often undertaken centrally);
- b) or in an informal, often ad hoc fashion by individual actors or groups, frequently based on implicit rather than explicit assumptions.

A number of different approaches have been adopted to anticipate changing skill needs. The traditional approach has usually involved formal, quantitative methods, focusing mainly on occupations. More recently, other, rather less formal methods have been developed, which have a strong qualitative emphasis. Often this has reflected problems or lack of key data. However, most exercises nowadays involve a mixture of both quantitative and qualitative methods, which are regarded as complementary. Increasingly, the focus is moving away from occupations to consider more general aspects of skill requirements.

The present review of the main forecasting methodologies suggests that a formal, quantitative behavioural, model is a very important foundation stone upon which such forecasting activity should be based. This should, in principle, enable a better understanding of the main factors influencing the supply of and demand for skills. However, it is important to go beyond the traditional 'manpower

requirements model', with its focus on occupational employment levels. Most recent work has emphasised the need to consider replacement demands and not just to focus on projected levels of employment. In addition, other more qualitative methods, involving surveys, case study work, focus groups and other techniques have all been found to have the potential for 'adding value' to the more traditional methods. Finally, a key feature of much recent work has been the emphasis on key or generic skills which go beyond the straight-jacket imposed by traditional occupational classifications, to look at the skills needed to do various tasks.

It is clear that the political, institutional and legal context, have had a crucial influence in the systems for labour market forecasting which have been developed across the world. In particular, this is reflected in the statistical infrastructure within which the analyst has to operate, including the development of macroeconomic and labour market forecasting models. Most of the countries where fully developed systems are in operation have invested very heavily in such activities over a period of many years. The impact of IT in this area has been immense. In the USA, for example, the development of ALMIS the American Labour Market Information System has facilitated all kinds of research and commercial activities in the area of Labour Market Information (LMI) and labour market forecasting. It has also facilitated the development of local as well as national level forecasts as in the UK.

The main conclusion from the review is that employment projections *can and do* provide a useful aid to policy makers in making decisions about training, recruitment and the personnel issues. It can also provide very useful information to a broad range of other actors in the labour market, including employers, individuals and education and trainer providers. This includes the development of 'early warning systems' to avoid bottlenecks, shortages and imbalances, which have been regarded as a serious problem in many countries. However, it is important to be realistic about the accuracy with which this can be accomplished. The idea of indicative planning

of education and training systems has long been discarded by labour market forecasters.

The value of such exercises depend crucially on the quality of the data upon which they are based, as well as the validity of the various assumptions built into the forecasts. To some extent the latter will depend upon the degree of sophistication of the models adopted, the more sophisticated the model the more likely it is to be able to deal with the many subtle influences on changing employment structures. A substantial investment by the public sector is necessary to support such activity, both to provide the basic data (which may also have a variety of other uses) and to support the forecasting activity itself.

Despite all the various problems associated with such activity, the experience of many countries, particularly the USA, suggests that useful forecasting tools can be developed at European level. This experience suggests that such forecasts can provide helpful information to both labour market participants as well as for policy makers about the labour market environment they are likely to face. It is therefore recommended that a regular European wide labour market forecasting exercise should be undertaken, supported by central government funds. This should include detailed occupational forecasts but also focus more generally on the changing supply and demand for skills (by sector, occupation, region, etc).

1. Introduction

1.1 Background to the project

Tessaring (1998) provided a brief general review of the methodologies used in employment forecasting. The present contribution expands upon this review. It provides a much more comprehensive and in-depth coverage than the Tessaring paper, which was concerned with a rather broader range of issues to do with the future of work. The present review covers the literature on what has traditionally been termed 'manpower planning', including the various quantitative forecasting mod-

els used at national level in many countries². However, it also extends the focus to include a number of new approaches to anticipating changes in the pattern of the demand for skills. The aim has been to summarise some of the key methodological issues in employment forecasting. The review also addresses questions concerned with the rationale for forecasting as well as some of the problems and pitfalls associated with it.

1.2 Aims and objectives

The key aims of the review are to provide:

- a summary of recent work on demand and supply forecasts at national level, broken down by sector, occupation and qualification, covering both European and other countries;
- a corresponding assessment of forecasting approaches and results at regional level, including an assessment of the importance of focusing on the local level (which some argue is necessary if such forecasts are to attain full operational relevance) as well as the problems and pitfalls in doing this;
- a comprehensive review of the different methods used and an assessment of their advantages and disadvantages in both national and regional cases. This includes an assessment of the various new approaches being used to anticipate changing skill needs, which have been advocated in recent years as well as a considered review of the various criticisms which have been made of more traditional methods;
- a corresponding review of the methods used and results obtained from assessing the future skill requirements at company

² Although this terminology appears increasingly outdated, given pressures towards equal opportunity and the use of non-sexist language, the term 'manpower' remains in regular use. The word planning has also come to be regarded in somewhat derogatory terms in some circles. The present review has adopted the alternative terminology of employment forecasting. This should be understood to refer to the analysis and management of all human resources.

level and their implications for the development of formal and informal skill training within companies;

- ❑ an assessment of the relevance of the forecasts for training provision, and the implementation of 'early warning systems' to avoid bottlenecks, shortages and labour market imbalances;
- ❑ an assessment of the need for a regular European forecasting activity concerning the supply and demand for skills (by sector, occupation, region, etc.).

1.3 Methodological approach to the review

An eclectic methodological approach has been followed in undertaking the literature search and review. This has involved various techniques to locate any relevant research being conducted in this area, including:

- ❑ a traditional literature search using bibliographical indexes;
- ❑ a computerised literature search using digital databases;
- ❑ use of network contacts:
 - based on the IER's established network, including members of the symposia held at the University of Warwick between 1989 and 1997,
 - contacts through an ongoing Leonardo project,
 - contacts through Cedefop;
- ❑ use of the world wide web to search for relevant sites and information;
- ❑ use of the IER's own website to attract interest and invite comment on the review as it is progressing.

The aim of all this effort has been to produce a comprehensive bibliography of recent research throughout the Community and beyond. The full bibliography, including subsec-

tions in Italian, German and Spanish, is attached to this report.

1.4 Outline of the report

Sections 2 and 3 provide a summary of the literature on general employment forecasting at national and regional levels. This discussion includes a review of the methodologies adopted as well as a summary of the main criticisms of the approach. The employment forecaster's responses to such criticism are also reviewed and an assessment of the benefits and limitations of such work is attempted. Recent changes in emphasis towards local forecasting and more qualitative approaches are discussed.

Section 4 extends the review to cover company level employment planning and forecasting. In parallel with the development of national employment models there was a growing interest during the 1960s in personnel planning at microeconomic level. Company employment planning began in earnest during the 1960s, although some institutions had undertaken this kind of exercise for many years before then. Much intellectual effort has been put into understanding the problems of wastage and recruitment to ensure that companies have the skills they require. Many very sophisticated statistical models have been developed, based on Markov methods. As at national level, the nature of such planning has changed over the years, with much less emphasis today on mechanistic manpower models. Nevertheless there is a considerable amount of effort devoted to forecasting wastage and assessing future recruitment needs. Most major companies and other large employing institutions are now well aware of the importance of human resource planning. Many now have personnel officers in quite senior positions whose main responsibilities are to deal with such problems.

Section 5 considers how the different political, legal and institutional frameworks in individual countries have shaped the kind of work which has been carried out in each case. A particularly important issue is how these factors have affected the statistical infrastructure in each country. This is dealt with

separately in Section 6. The importance of development of standard systems of classification, the need for regular and detailed employer and household surveys on employment structure and the advantages of electronic access via the internet are discussed. Some of the key methodological issues in employment forecasting are reviewed in Section 7. These include: the limits to our understanding of socioeconomic systems; inadequacies in data; and ending with a brief discussion of various other technical, methodological problems. Finally, Section 8 contains the main conclusions.

2. A general review of employment forecasting

2.1 Background

Employment forecasting first became prominent during the early 1960s when economists were concerned about problems of both structural unemployment and labour shortages. Initially, it was hoped that governments would be able to intervene, especially on the supply side of the labour market, to ensure a balance between the demand for and supply of skills.

The initial optimism of the planners was soon dented, both by technical and practical problems in producing accurate forecasts, as well as a barrage of theoretical criticism, which questioned the whole rationale for employment forecasts. Although these criticisms have been rejected to some extent, the nature of the employment forecasting undertaken in the 1990s is now very different from that attempted in the 1960s. Forecasts of both the demand for (and in a few cases the supply of) skills at national level are regularly undertaken in most of the major OECD economies. However these assessments are very different from the indicative type planning exercises attempted by the pioneers of the 1960s. In particular, the attempt to develop a direct link between the changing pattern of demand for skills and the regulation of the intake into education and training courses has now been recognised as impractical in most countries.

Current labour market assessments emphasise the implications of past patterns of change for the future demand for skills, often using quite sophisticated econometric models. The aim is to present policy-makers with information on the labour market environment that they may face if such trends continue. They may also attempt to assess the effect of different courses of action. The information provided by such assessments is only one of the necessary inputs into decisions about the scale and content of different education and training programmes which government officials, education and training providers, companies and trade unions will need to use in developing their strategic thoughts.

However, current thinking, in most but still not all countries, is that the scale of education and training programmes needs to reflect the demand from *individuals*. In most market oriented economies, the latter are regarded as best placed to make choices based upon a vast range of micro as well as macroeconomic information, which a bureaucrat would not be able to take into account. It is felt in many such countries, that individuals need good labour market information to help them make the best choices.

In countries such as the USA and the Netherlands, very detailed information, including forecasts, are regarded as an essential part of this. In many others more general macro level projections are becoming more readily available and are seen as having an important role to play in making young people and others who make career choices aware of labour market trends. While it is recognised that such information may offer only a broad brush picture of the possibilities facing those making training and career development choices, it can provide an important input for use in vocational counselling and guidance by practitioners who are aware of its limitations.

In practice, such projections will often provide only general guidance on such matters, although in some countries much more detailed information is available. In many (if not most) cases, of course, the labour market prospects in a chosen career path will not be the major factor in an individual's decision. Nev-

ertheless, if such decisions are to be made efficiently, it is important that individuals have the best information available, even if they choose to discount it.

Nevertheless, it is important, right from the outset, to recognise the limitations of employment forecasting. It is important to avoid the pitfall of thinking that it is possible to develop computerised models which can provide accurate predictions of the future demand for training. The lessons from almost 40 years of research caution against this. Despite these caveats, the present author is firmly of the view that formal forecasts can provide useful information for policy-makers and the various actors in the labour market, as long as it is used in combination with other relevant information and its limitations are recognised.

2.2 Employment forecasting: a brief history

Employment forecasting has been undertaken, in one form or another, for many years. The literature in this area dates back at least to the 1950s. Ahamad and Blaug (1973) wrote of the need to review the previous 20 years of experience of manpower forecasting. In carrying out this review, they identified examples of forecasting for all occupations and for single categories of worker in several developed and developing economies around the world. There is now an enormous literature covering work at both a macro and micro level.

The previous work by Tessaring (1998) covered a limited range of work conducted at national level within a few major European countries. Tessaring (1998) referenced a large number of works, including some general reviews, which have explored these issues, such as Eijs (1994), Heijke (1994) and Youdi and Hinchliffe (1985).

A number of other useful reviews have been conducted, to which the interested reader is referred for more detailed discussion, see for example, Hopkins (1988), Hughes (1991), Colclough (1990), Smith and Bartholomew (1988), Meltz (1996), Haskell and Holt (1999) and, most recently, Strietska-Ilina (1999).

The document by Hughes (1991) contains a particularly comprehensive review of many of the technical issues, including details of work in the USA and Canada. Meltz (1996) reviews the position for Canada, while Heijke (1994) contains chapters by many of the leading European practitioners. Haskell and Holt (1999) have brought things up to date with a critical review of the merits and limitations of such work, albeit focusing on the UK experience³. Most recently Strietska-Ilina (1999) has provided a review of practices in France, Germany, Ireland and the Netherlands as well as a number of eastern European countries. The present section attempts to provide a summary of the main features of this literature.

During the 1960s employment forecasting became prominent at national level as economists attempted to advise governments on how to avoid imbalances between the supply and demand for skills, (whether appearing as structural unemployment or skill shortages impeding economic growth). One of the most influential works was done within the OECD-Mediterranean project in the early 1960s, Bombach (1965). At that time it was hoped that detailed employment plans could be developed which could be used to guide policy decisions relating to the provision of educational and training programmes at a very detailed level (i.e. for particular levels of qualifications or skill).

In practice the methods adopted at that time tended to be rather naive and mechanistic. As a result, these early forecasts were usually very inaccurate, especially on the supply side. The typical methods adopted involved linking the demand for particular skills to output projections for different industries, often via some form of input-output model (see for example Parnes 1962). The links were generally a series of fixed coefficients. This assumption was heavily criticised as failing to recognise the possibility of substitution of one factor of production (or skill) for another, (see for example, Ahamad and Blaug 1973).

³ In a paper prepared for the Skills Task Force, which has been set up to advise the UK Government's Secretary of State for Employment.

2.3 Criticisms of employment planning

Many of the early models used for employment forecasting were not explicitly specified in a quantitative form. Such forecasts could not be evaluated by statistical methods (see Ahamad and Blaug 1973). Where quantitative evaluation did prove possible there were often large errors in the forecasts for different occupations. As might have been expected, the errors tended to increase the longer the time horizon of the forecast. Most of the early demand forecasts were derived from fixed coefficient models which were prone to error. On the supply side the forecasts were highly simplistic, with no attempt to examine the implications of variable retirement or wastage rates.

A number of criticisms of the general manpower requirements approach have been offered (see, for example, Colclough 1990):

- ❑ that national level employment planning is irrelevant because markets will respond of their own accord to ensure that the correct skills are produced;
- ❑ that the fixed coefficient approach is invalid since it ignores the possibilities of economic substitution;
- ❑ that inaccuracies in the assumptions will be compounded making the projections of little value;
- ❑ that such approaches focused solely on economic considerations without reference to wider social implications;
- ❑ that past imbalances were often ignored and carried forward into the projections;
- ❑ that the approach did not allow for interaction between supply and demand factors.

Employment forecasters have rejected all these criticisms. With regard to the first criticism, they point to evidence of market failure (reflected in persistent skill shortages, which seem to be a feature in many countries) and to the long-lags in training (which can lead to

temporary but long-lasting imbalances in occupational labour markets).

With regard to the second point they highlight empirical evidence that the elasticity of substitution for skills is low and argue that wage structures tend to exhibit stability over the long term. More recently, improvements in methodology have opened up the possibility of allowing for substitution possibilities explicitly in the econometric models which can be built (although this remains the exception rather than the rule).

The third criticism is rejected on the grounds that the problem of forecasting inaccuracy is not unique to employment forecasting but applies to any economic projections. Evidence does not suggest that employment forecasts are significantly more inaccurate than any others. Moreover, there is considerable evidence that policy makers have found these useful, (see Strietska-Ilina 1999, Borghans et al. 1998 and Meltz 1996).

The fourth point has been answered by introducing a broader range of disciplines into the process and recognising that economics is only one of a number of important considerations to be borne in mind. The fifth and sixth points have been addressed by attempts to deal with these limitations, taking such factors into account explicitly, in a manner which was not possible in the pioneering studies.

More recently, a more general criticism has been characterised by a quotation from a French manager who stated that 'the term planning is imbecilic; everything can change tomorrow' (Mintzberg 1994).

Occupational projections fell into disrepute in France during the 1970s when the fifth and sixth economic plans were blown off course by the oil crisis and subsequent sectoral readjustments. As a consequence, the seventh economic plan abandoned direct confrontation of detailed demand and supply projections, (see Paul 1985). Indeed, occupational projections were omitted altogether from the eighth economic plan. Nevertheless, the demand for occupational forecasts continued, with an in-

creasing emphasis on decentralisation, (see *Commissariat General du Plan* 1991). A review of more recent developments in employment forecasting in France is given in Giffard et al. (1999).

The kind of views expressed by the French manager implicitly assume that planning involves a quite mechanistic process based on the past, that it is more backward than forward looking. However, most practitioners have a much more open-ended view about what planning (and forecasting) can provide. Reilly (1996) sees the process as:

- conscious,
- explicit,
- analytical,
- purposive,
- forward looking,
- dynamic,
- aggregate (broad brush),
- quantitative.

Such a view is certainly characteristic of the philosophy behind much employment forecasting (see for example, Wilson 1994 and Lindley 1994). Indeed, some would argue that one of the main benefits of such activity is in posing the questions rather than providing precise answers (Pascale 1991).

2.4 Employment forecasting in the 1990s

As a consequence, employment planning at national level has continued to be practised, albeit in a less mechanistic and indicative fashion. During the 1990s a growing consensus developed that conventional manpower planning was too mechanistic and inflexible to meet changing economic conditions. Criticisms of conventional employment planning were advanced by Psacharopoulos (1991) and Castley (1996a, 1996b), amongst others. Psacharopoulos (1991) has advocated that manpower planning should embrace a much fuller labour market analysis which would include measurement of wages, wider use of household surveys and skill and educational profiling of the working population. The emphasis has moved away from employment planning towards more general labour market assessment and

forecasting, with the emphasis on anticipating change.

Most developed countries now undertake regular labour market projections. However, these are used more as general aid to policy makers and labour market participants to illustrate the implications of a continuation of past patterns of economic and labour market behaviour for the future, rather than as an indicative input into educational planning. It is emphasised by most practitioners that such assessments should be regarded as a broad-brush guide to the sort of environment that labour market participants and policy-makers may face, rather than a crystal ball. It is notable, however, that in some of the far east 'tiger' economies there is greater adherence to the notion of indicative planning than in many western countries.

In some countries, such as the USA and the Netherlands, more detailed projections are still conducted although these are not carried out with the idea of supporting precise indicative planning of education to match changing demand patterns. There are also many recent examples of employment forecasting at below the nationwide level. These include the development of local area employment models and the production of detailed forecasts for key industrial sectors (e.g. the engineering industry) or important occupational sub-groups (e.g. highly qualified workers).

Employment forecasts can be subject, of course, to wide margins of error but this does not invalidate them, any more than it does other economic forecasts. One of the key problems in all social science forecasting is that the forecast itself may alter behaviour and indeed this is often a key objective (see, for example, Wilson 1994 and Meltz 1996). In any event, as Cairncross (1969) notes, forecasts should not be taken too literally or as telling policy-makers or individuals what to do. They should be treated as one among many pieces of information, which is needed before taking decisions and which can be used to help evaluate the risks to be faced. Employment forecasts can contribute to the decisions which have to be taken with regard to education, training, and choice of occupation by provid-

ing, as Colclough (1990, p.20) argues, ‘a detailed, consistent and plausible picture (if properly done) of how the future might look’.

More recently criticisms of employment forecasting have focused on the question of how relevant traditional occupational projections are for both policy-makers and other labour market participants. One criticism was that many such projections failed to recognise the significance of replacement demands (Dekker et al. 1994). More recently, there has been growing concern that the focus on occupations fails to get to grips with the skill requirements that employers have or the skills which individuals need to acquire to gain and retain employment. The response of the practitioners to these criticisms is discussed below (in Section 3.2.1) but essentially they have extended their analysis to include these elements.

3. Methodological approaches

3.1 Alternative methods

There are a number of different approaches that have been adopted to anticipate changing skill needs. Some, particularly the more traditional approaches, involve formal, quantitative methods. Others, especially some of the more recent attempts, are rather less formal and have a strong qualitative emphasis, involving the use of multidisciplinary methods. Such methods are not primarily concerned with precise quantitative measurement. All of the following have been used at different times and in different contexts. The main approaches that have been used are as follows:

- a) quantitative methods:
 - mechanistic/extrapolative techniques,
 - behavioural/econometric models,
 - survey of employers’ opinions,
 - skills audits;
- b) qualitative approaches:
 - Delphi techniques (consultation of expert opinion),
 - case studies,
 - focus groups,
 - holistic modelling approaches.

3.2 Quantitative modelling

3.2.1 Traditional approaches to employment forecasting

For many years the dominant technique has been quantitative modelling, using a combination of behavioural/ econometric models as well as more basic extrapolative techniques (where the data are inadequate to apply more sophisticated methods). Typically, quite sophisticated, behavioural models are used, with parameters estimated using econometric methods where the data are good enough to permit. This usually includes the macro-economic and sectoral employment aspects. More basic extrapolative techniques are used where the data are less adequate, notably for producing more detailed breakdowns of employment by occupation and qualification.

Pioneering work in this area was undertaken in the USA by the predecessors to the Bureau of Labour Statistics (see, for example, Department of Labor 1963 and 1965); in France, where the occupational dimension was included in the fourth economic plan for 1962-65; and in the OECD Mediterranean study (Bombach 1965). This was followed up by work in Canada by the Federal Department of Labour, in Germany by organisations such as the *Institut für Arbeitsmarkt-und Berufsforschung* (Institute for Employment Research – IAB) and in the UK by research conducted by the Institute for Employment Research (IER), funded by the Department for Education and Employment⁴. The US approach is summarised in Figure 1, while a summary of the situation in the UK is given in Figure 2.

A detailed review of the German approach can be found in Tessaring (1997). This highlights the increasing diversity of methods and data sets that have been used to tackle the problem of anticipating labour market change in Germany. The combination of econometric,

⁴ When IER first started its work on occupational forecasting in 1975 it was known as the Manpower Research Group, while the DfEE’s predecessor, the Manpower Services Commission, managed the research on behalf of the then Department of Employment.

survey and other approaches is typical of the way the methodology for undertaking employment projections has been developing over the past 10 to 20 years.

Similar work has been conducted in many other European countries. Strietska-Ilina (1999) describes the current positions in France, Ireland, the Netherlands as well as Germany. Tessaring's (1998) review also details models used in countries such as Finland, Germany, Ireland, the Netherlands and the UK. Recent reviews of the situation in France, Germany, Italy, Spain and the UK can also be found in a series of papers produced as part of an ADAPT project, (Blin 1999, Schultze and Reimers 1999, Vergani and Muscella 1999, Antonio 1999 and Wilson 1999).

Other countries have made only limited progress in this area. For example, in Austria the collation of key economic and employment statistics is carried out by the Austrian Central Office for Statistics (ÖSTAT) but this body does not carry out any forecasting work. Rather, organisations such as the Institute for Advanced Studies (IHS) do such research. They use a macroeconomic model (link model Austria, LIMA) to produce a set of highly aggregative forecasts. A second set of forecasts is produced by the Austrian Institute for Economic Research (WIFO) who use a model which is capable of some disaggregation into different sectors. The forecasts of these two institutes are critically important and they are presented regularly to government officials and Austrian social partners. Fuller details on the Austrian forecasting approach can be found in Lassnigg and Mayer (1999).

Important work has been carried out outside Europe and the USA. The main national economic model used to forecast employment in Australia and more recently adapted by South Africa, Pakistan, Thailand, Indonesia and China, amongst others, is the ORANI model. Work on this model began at Monash University in 1975 and the original specification of the multisectoral model was described in Dixon et al. (1982). The features of the original model were a facility for multiproduct industrial sectors, elasticities of substitution between domestic and imported goods and services,

technical change variables for all commodities, very detailed treatment of key distribution and transport sectors and a regional dimension. This basic model format is published as ORANI-G (Horridge et al. 1998), where 'G' stands for the generic version of the model and details are now available on the internet (www.monash.edu.au/policy/oranig.htm).

The Australian model has been extensively revised and upgraded since its inception. The comparative-static framework has been replaced with dynamic equations arising from stock/flow accumulation between capital stocks and investment and also between foreign debts and trade deficits. Other extensions to the basic model have included systems of government accounts and fuller regional breakdown of model results. The present model contains 112 industries (defined according to the Australian standard industrial classification), which map into some 21 broader industrial groups. A variant on the ORANI is the version developed at Monash (Malakellis and Dixon 1994), which exhibits a higher degree of disaggregation for households, occupations, sectors and regions. In particular it yields employment forecasts for some 283 occupations across some 56 regions.

Improvements in modelling techniques have resulted from the significant investments made in IT equipment and data, as well as from the more general advance in economic scientific methods over this period. All of the governments mentioned above have supported such developments indirectly via their funding of academic research efforts in higher education. The latter has also been facilitated by the effects of the IT revolution on the ability to handle increasingly complex statistical problems with increasingly less effort. Statistical and econometric modelling techniques have been particular beneficiaries. In addition, the general process of scientific advance (which has benefited from the massive expansion of investment in education and research and development worldwide) has had a major impact.

The availability and accessibility of labour market data has gradually improved since the early 1970s, again linked to the IT revolution. This has again been a feature common to all

Figure 1: The US approach to labour market forecasting

The US Bureau of Labor Statistics (BLS) has a long involvement with model-building to forecast employment by industry and occupation for at least 10 years forward. Bureau projections are based upon extensive detailed econometric modelling of output and employment relationships. Data are used from a number of different BLS surveys, current population surveys, Bureau of the Census surveys of business, as well as national income and interindustry accounts. Forecasts are produced for some 500 to 1,000 detailed occupations and some 240 industrial sectors (precise numbers vary with particular types of analysis). The results of the projection exercises are published in a number of journals (the key one being *Monthly Labor Review*), as well as on the internet (<http://stats.bls.gov/emphone.htm>).

A full up-to-date account of the BLS approach to employment forecasting is provided in *Bureau of Labor Statistics* (1997). The key component of the forecasts is the input-output accounts which are only updated periodically. The most recent set of US forecasts is based on the 1987 input-output matrix which is projected forward using RAS methodology. Similar problems arise in allocating the final demand product groups to detailed commodities and this exercise requires the use of an updated bridge table. The whole modelling exercise critically depends on the maintenance of regular and consistent time series observations on industry and commodity outputs, employment, hours worked, wages and salaries and critically, on occupational staffing patterns. The staffing information is derived from a series of surveys conducted by individual state employment security agencies. These data are complemented by occupational information provided by federal government employees as well as for self-employed workers, agricultural workers and for those employed in the private household sector.

The efficiency of the BLS forecasts is heavily dependent on the quality of its data inputs to the model. Improvements invariably require the development of new or refined data series. The available data is seen as the major limitation on the forecasting exercise. One of the latest developments in the US has been the coming on line of the O*NET system which has been designed to focus on skill needs in great detail and is intended to provide useful information for careers guidance.

these countries as well as to most other European countries. Although there have been some notable set backs, the overall position in the late 1990s is vastly better than when labour marketing forecasting first started⁵.

A number of early national economic models which contained a significant employment forecasting dimension were reviewed by Hopkins (1988) for the International Labour Organisation. Amongst the models which were examined were the Cambridge multi-sectoral model for the UK, the French and Dutch equivalents, as well as the overall OECD interlink model, which was an attempt to tie together some major economet-

ric models in use across the world. Table 1 provides a listing of the link participants in the early 1980s and so shows the international interest in employment forecasting at this date.

Some of the broad conclusions reached by Hopkins (1988) are worth noting, although developments since the early 1980s have served to invalidate some of the findings. The actual prediction records of the major models were found to be very mixed with the most inaccurate sets of forecasts arising from the interlink exercises. Most models were superior to very naive predictions but many did not inspire much confidence with regard to detailed projections. This of course, was a conclusion from many of the very early indicative planning exercises. Nevertheless, the forecasting models were found to be useful for exploring a range of alternative scenarios rather than for making precise predictions.

⁵ For example, in the UK, a number of major surveys, including the planned 1976 census, were cancelled and there have from time to time been significant cuts in expenditure on many key national data sets.

Figure 2: The UK experience of labour market forecasting

The first serious attempt at employment projections in the UK were produced in the late 1970s using a modified version of a static multisectoral macroeconomic model developed by Professor Richard Stone and his colleagues in the Cambridge Growth Project (CGP). Subsequent forecasts used improved versions of this model which was the subject of a continuous programme of development both by the CGP (and its successor, Cambridge Econometrics (CE), a private sector organisation) and the Institute for Employment Research (IER). National government funding from the Department for Education and Employment (DfEE) and its various predecessors supported this work.

More recently, the emphasis in the UK has changed to the local rather than national level. After 1988 the responsibility for delivering government training programmes for young people and the unemployed passed to the local level. Local organisations have often conducted their own surveys of employer's labour and training needs. Many also commission forecasts. Various software packages have been developed to exploit the data collected by DfEE and made available on National Online Manpower Information System (NOMIS).

Careers guidance companies in the UK have also recently been privatised (previously they were part of local government) and are now taking an active interest in anticipating future labour market conditions on behalf of the clients they advise. They also operate at local level. Moreover, education and learning suppliers (colleges, universities, etc.) have been charged with the responsibility of ensuring that the courses they provide are relevant to future labour market needs.

Recently, a new series of Industry Training Organisations (ITOs) have been set up in the UK, operating at national level. These include the Construction Industry Training Board (CITB) which is the ITO for construction and the Engineering and Marine Training Authority (EMTA) which covers engineering. Others cover areas such as agriculture, distribution and security services.

The Skills Task Force is a national body set up by the Secretary of State for Employment in 1998 to assess the UK's future skill needs. It has members from a broad range of companies although it is not intended to be representative. It has commissioned a number of research studies including a major project on skills deficiencies. This research is intended to identify the nature, causes and implications of skills deficiencies in the UK. It involves an eclectic set of research methodologies, including in-depth case studies, large-scale survey work and econometric analysis.

Specification in these early models varied quite markedly and it was subject to much change. Several models used a mixture of econometric modelling combined with expert subjective judgement. A strong case could be made for better specification and the incorporation of a fuller set of labour market variables. Estimation techniques have improved very significantly since the early 1980s and, taken together with greatly enhanced computing power, this has enabled far superior model specifications to be produced. Most of these models were restricted to macroeconomic and employment forecasting, by sectors, although a number have been extended to include further characteristics such as occupation and qualification.

During the 1970s and 1980s many of these countries' governments invested heavily in macroeconomic model development⁶. In the USA and Canada, such work has been undertaken directly by the government. In Canada the work of the Federal Department of Labour

⁶ In the UK, this included major programme grants (via the Economic and Social Research Council and its predecessors) to various organisations for the development of general macroeconomic models, as well as the DfEE's own support for work specifically concerned with the labour market. This was substantially reduced in the 1980s and the 1990s due to cutbacks in public expenditure. Currently the DfEE is supporting such activity through the auspices of the Skills Task Force set up by the Secretary of State for Employment.

Table 1: Interlink participants in early 1980s: models for labour market forecasting

Models for OECD countries		
Australia	University of Melbourne	
Austria	Institut für Hoehere Studien, Vienna	
Belgium	Université libre de Bruxelles	
Canada	University of Toronto	
Denmark	Danmarks Statistik, Copenhagen	
Finland	Bank of Finland, Helsinki	
France	INSEE, Paris	
Germany, Federal Republic of	Universität Hamburg	
Greece	KEPE, Athens	
Iceland	LINK Central, Philadelphia	
Ireland	Central Bank of Ireland	
Italy	Università di Bologna	
Japan	Kyoto University	
Netherlands	Central Planning Bureau, The Hague	
New Zealand	Reserve Bank of New Zealand	
Norway	LINK Central, Philadelphia	
Portugal	LINK Central, Philadelphia	
Spain	Universidad Autónoma de Madrid	
Sweden	Stockholm School of Economics	
Switzerland	Université de Lausanne	
Turkey	LINK Central, Philadelphia	
United Kingdom	London Business School	
United States	University of Pennsylvania/WEFA, Philadelphia	
Yugoslavia	LINK Central, Philadelphia	
Models for centrally planned economies		
Bulgaria Czechoslovakia German Democratic Republic	} United Nations	
Hungary		University of Lodz
Poland		Market Research Institute, Budapest
Romania USSR	} Wharton, EFA, Philadelphia	
China		Stanford University
Regional models for developing countries		
Africa Asia Latin America Middle East Pacific Far East	} United Nations	

Source: Hopkins (1988).

has been carried forward by Human Resources Development Canada (HRDC), which is a part of the federal government. In the USA the BLS's work in this area has gone from strength to strength. In the UK, the Institute for Em-

ployment Research (IER) an academic research unit has conducted this work for most of the past 25 years, while in Germany and France a combination of academic and public research institutions have led the way.

The approaches to generating national projections have gradually been refined and improved in parallel with the development of macroeconomic modelling more generally. These improvements have resulted from:

- significant investments in methodological advances;
- improvements in techniques and understanding;
- huge increases in the ability to handle and process data;
- improvements in the availability and accessibility of data.

Many of these elements are interconnected and related to the general effects of the IT revolution.

3.2.2. Spatial disaggregation

The approaches adopted in most countries involved the development of national models covering all sectors. From an early stage such analyses have often also included a spatial (regional) dimension.

In the USA, separate results for individual states have been produced for many years. In Canada, although the initial work focused on the national level, demand for more local information soon led to the addition of regional/provincial dimensions (Meltz 1996). Many of the results for other countries, including France and Germany also include regional dimensions.

These developments reflect both institutional factors and data availability. In the case of the UK, for example, detailed analysis of the standard regions of the UK (which include Wales, Scotland and Northern Ireland as well as the nine regions of England) have been conducted for many years. However, the UK regional projections only covered sector and not occupation until the early 1990s. The reintroduction of occupational projections at regional level in the UK reflected the shift in emphasis towards local provision of education and training programmes, with the introduction of the Training and Enterprise Councils (TECs and the corresponding LECs in Scot-

land). More recently this has led to the further narrowing of the geographical scope to a focus on the areas covered by the new regional development agencies.

In France, every region has, since the late 1980s, had a regional employment and training observatory (OREF). These were intended to develop decision-making tools to allow the linking of analysis, data and forecasting for education and training in support of decentralisation. In Germany, the importance of the local dimension has also long been recognised, the role of the *Länder* in education and training provision being critical. These examples highlight the importance of the political, institutional and legal contexts in shaping both what is regarded as desirable as well as what is feasible.

3.2.3. The 'demand' for skills

The demand side of employment forecasting has adopted a variety of different methods. The most common method involves some form of econometric macroeconomic model. In the early days the fixed coefficient, 'Manpower requirements' approach, was the most common method of dealing with the demand side. As noted above, this usually involved making a series of links from gross national product (GNP), or other measures of individual industry output, to employment. From there, further links to the demand for particular skills, were made, usually focusing on occupations. In most of the early employment models the latter links were all in the form of fixed coefficients. More recently the models used have been more sophisticated, allowing for changing coefficients and responses to economic variables such as prices and relative wages.

Details of the methods used have been summarised in Tessaring (1998) and in the earlier review by Hughes (1991), so they are not repeated here. It is perhaps worth noting that most of the early models concentrated on just two main dimensions: industry (or sector) and occupation⁷. More recently, there has been

⁷ Having said that, many of the very early studies also had a focus on educational requirements, including qualifications.

more effort to add a third dimension relating to qualification, skill or educational requirements, although such efforts often remain constrained by lack of adequate data.

In the early 1990s criticisms of employment forecasting have focused on the question of how relevant traditional occupational projections are for both policy-makers and other labour market participants. One criticism was that such projections failed to recognise the significance of replacement demands (Dekker et al. 1994). It was emphasised that projections of occupational employment levels failed to recognise the need to replace those leaving the workforce for retirement and other reasons. This has now been remedied in many models (for example, the current models for the Netherlands, the USA, Canada and the UK all now deal with such matters explicitly).

More recently, a key feature of much work has been the focus on key or generic skills which go beyond the straight-jacket imposed by traditional occupational classifications, to look at the skills needed to do various tasks. There has been growing concern that the focus on occupations failed to get to grips with the skill requirements that employers have or the skills which individuals need to acquire to gain and retain employment. The Department of Labor in the USA has been developing the O*NET database, which identifies, defines and describes various aspects of occupations, including the various generic skills typically associated with each job. Much of this information has been made available on the Internet. In the UK the Skills Task Force has also been taking a strong interest in such issues and a number of recent studies have attempted to grapple with this issue (see, for example Haskell and Holt 1998). Green (1998) has tried to demonstrate the value of different types of key and generic skills using hedonic wage equations, while BSL (1998) have tried to apply such concepts directly, in a skills assessment exercise for Wales. In Germany the IAB has used employer surveys to get more detailed information on the nature of jobs but this has tended to focus more on functions, such as R&D, rather than key skills (such as IT skills).

Thus the simple notion of concentrating upon just two (or three) key dimensions (industry, occupation and possibly qualification) is now being superseded by a multidimensional approach. This involves the use of terms such as functions, tasks, abilities, personal attributes, characteristics and generic skills. In many cases the precise use of these terms has yet to be widely agreed. Until they have been standardised, as is the case for industry and occupation, these dimensions will remain difficult to operationalise. Nevertheless, there seems to be widespread agreement that the two or three dimensional approach adopted in most traditional forecasts, will become increasingly irrelevant to policy-makers and individual labour market actors alike.

3.2.4 Employer surveys

The main alternative approach to anticipating changing skill needs has involved surveys of employers. To many people, it seemed that the obvious way of assessing employers' future skill needs was to go out and ask them directly. In the early days of 'manpower planning' and up until the late 1960s and early 1970s, this was a very popular approach. However, it was the subject of especially strong criticism. This centred upon the lack of any firm theoretical foundation as well as the practical problems of ensuring that all respondents to the survey were adopting common assumptions about the future scenario and that their responses were mutually consistent. For example *all* the firms in an industry cannot increase their market share *simultaneously* (see for example Ahamad and Blaug 1973). It fell into disrepute when projections produced for organisations such as the UK's Engineering Industry training Board (EITB), relating to engineering skills, turned out to be highly misleading. Lack of consistency in the underlying assumptions adopted by the respondents, and in particular conflicting views about future market share, resulted in very inaccurate projections.

Rajan and Pearson (1986) revived such methods in the UK in the mid-1980s. Theirs was a major survey of companies at national level. It was as much concerned with reviewing current trends and their causes as making pre-

dictions for the future. It also took a more qualitative than quantitative emphasis than many of the previous survey studies. Their work showed that this approach could, if used with care, produce useful results. Their main value is where the available data are inadequate to build more sophisticated time series econometric models (and as such they are still widely used in developing countries).

This contrasts with the results from a number recent employer surveys commissioned by TECs in the UK to provide information and intelligence on key issues of concern to themselves and their local economic development partners. Some of these surveys have been of a very ad hoc nature and have produced data of dubious quality.

Others have been conducted in a much more structured and thoughtful manner and have both avoided the worst pitfalls of such approaches and provided valuable insights. A good example of the latter in the UK is the London TEC's employer survey (London TEC Council 1998). This generated a range of information on current structure and performance and immediate future prospects. The results focus on size of firm as a key issue but also move well beyond simple issues of quantitative changes, attempting to discern what is driving the observed changes. Issues of location of plant and inward investment are a key focus. However, the general consensus has been that such surveys can only provide useful indications for a very short period ahead.

There has been something of a revival of interest in this approach in recent years in the UK, with many TECs conducting regular surveys of the employers which they serve. However, these surveys are concerned with a range of issues and often do not attempt to obtain hard quantitative data on future skill demands.

Such approaches have also been popular in a number of other European countries where data from national/official sources are inadequate or do not exist (see for example Vergani and Muscella 1999 and Antonio 1999). However, they can also be an important complementary element to more quantitative mod-

elling approaches. For example, the work of Prognos and the IAB for Germany since the mid 1980s has also made use of such survey results (see Tessaring 1997). They also form an important element in the French approach (Giffard et al. 1999).

Although the value of the employer survey method for obtaining direct *quantitative* data on future requirements has been brought into considerable doubt, it can still have some value in obtaining a more *qualitative* picture about the state of a particular labour market. In such a guise it may have much in common with so-called 'Delphi' techniques used to assess future prospects in areas that are hard to quantify. This approach relies on obtaining a consensus of expert opinion. This method has seen renewed interest in the late 1990s as researchers and policy makers have sought to add value to the basic quantitative approaches based on econometrics. Another aspect which has been given considerable attention in recent years, is the use of such surveys to obtain data about detailed aspects of employers' skill requirements, including information on, so called, key generic skills (see for example Mori et al. 1998).

3.2.5 Modelling supply

On the supply side, the typical approach has been to develop simple stock-flow models relating the total stock of employment in period t to that in period $t-1$, using an accounting identity linking the main inflows and outflows to the stock. Supplementary models to determine the proportion of the stock that is economically active (and if it is a particular occupation that is of interest, the proportion actively engaged in that particular job) have also been used. The main outflows considered are those due to death, retirement and other exits from the workforce and emigration. The main inflows relate to the flow of new entrants (qualified as appropriate), reentrants to the workforce and migration. If the focus is on particular occupational categories, then interoccupational mobility also needs to be considered. These approaches drew upon micro level company planning procedures, where often very comprehensive and detailed data were available to estimate and model such flows and transitions.

At national level, quite sophisticated systems of demographic accounts began to be constructed in the 1960s in many countries. These were intended to parallel the national economic accounts. However, lack of government interest in most countries (with one or two notable exceptions, such as the Netherlands) has meant that these have not been developed to anything like the same extent as the economic and financial accounts. As a result employment models have not flourished to the same degree as the macroeconomic models based upon the economic data. Nevertheless, employment forecasters have made attempts to fill the information gaps from various ad hoc surveys and to build models which allow for some response in flow and activity rates to economic and other factors.

In the more sophisticated models, detailed econometric analysis of time series data has been undertaken to explain historical changes in rates of flow and economic activity rates, with a view to projecting them into the future. Where data are more limited these rates are assumed fixed or extrapolated from a few observations. Data limitations have meant that in most countries the more sophisticated models are restricted to particular occupational categories, where good information on the various stocks and flows are available (see for example the treatment of highly qualified occupations in Wilson et al. 1990). Only where particular emphasis has been placed on collecting and analysing such data have more general models been developed covering all occupations (see for example the work of Heijke 1994 and the contributions for Germany, Netherlands and the UK in this reader).

It is also worth mentioning that so called skills audits (generally based on surveys of qualifications held by individuals) have also been widely used in recent years to establish the stock of skills available in particular local areas. These are surveys of households rather than employers. They are primarily concerned with assessing the supply of skills rather than the demand side of the labour market. However, such surveys can play a useful part in obtaining a complete overview of the supply demand balance.

3.3 Qualitative Methods

A variety of different types of study and approaches can be considered under this heading. They share in common the fact that they are not primarily concerned with obtaining precise or comprehensive *quantitative* measures of employer's skill requirements but rather a broad brush assessment of current trends and future possibilities. At the same time such studies can often involve a very detailed analysis of the particular circumstances affecting the sectors or occupations under review. They can be very useful in situations where the statistical infrastructure is not good enough to support quantitative model building.

Such methods are being employed in many countries to complement more traditional quantitative approaches. In France, for example, Giffard et al. (1999) describe the use of a variety of techniques to monitor and anticipate change. These have been increasingly popular in France since the more mechanistic quantitative approaches to planning fell into disrepute after the oil crisis of the 1970s and early 1980s. They often involve the input from a number of social partners as well as labour market analysts.

Such methods have also been widely adopted in a number of southern European countries, which do not have such good labour market statistics as some of their northern neighbours (see for example, Vergani and Muscella 1999 and Antonio 1999). Such methods do have some advantages compared to more quantitative ones (which can sometimes give a misleading impression of precision). They have therefore also been used to complement the quantitative methods.

The Delphi approach to forecasting involves pooling the opinions of a number of people (possibly experts of some kind) in order to try to identify the key issues. This can be done in a variety of different ways. The classic method is to bring the experts together in a suitable forum to exchange views and hopefully to develop some form of consensus. Another approach is to interview people and discuss the matter, possibly in a structured fashion. This

can be used to develop 'case studies', which can have some general messages. In this case the researcher/interviewer may be the only one to hear all the views expressed. They have then to make sense of all this, sometimes conflicting, information.

The UK's National Institute for Economic and Social Research has established a long and distinguished track record of such work (see, for example, the various works of Prais, Mason and Steedman listed in the bibliography). Such studies tend to focus primarily on the current situation and often involve detailed international comparisons. Anticipation of future change is generally very qualitative. Nevertheless this can add important insights which complement and support the results of more quantitative projections. This kind of approach has also been adopted in a number of other countries.

Another method, which has become increasingly popular, is to arrange 'focus groups'. Discussion of the topic of interest is then arranged, possibly based around material submitted in advance and possibly involving some kind of facilitator to prompt and structure the discussion. This type of approach is a feature of an ongoing EC ADAPT project being conducted by the UK's Engineering and Marine Training Authority (EMTA 1998). This has also involved partners in other Europe. Many other projects of a similar nature are being conducted across Europe under the auspices of the ADAPT programme. This type of approach has also been adopted in many other studies such as the UK's Merseyside economic assessment (KPMG 1996).

3.4 Non-traditional modelling

A number of analysts have attempted to develop less quantitative, more holistic approaches to assessing long-term futures. Such work is often focused on the notion of sustainable development and social cohesion. In the UK, the Henley Centre study of the future of work in London is a good example (see London TEC Council 1998).

In the Henley Centre approach, local competitiveness is viewed as a function of social cul-

tural and environmental factors as well as purely economic ones. Both long and short-term drivers of competitiveness, thus broadly defined, are distinguished. These are proxied by around 50 different indicators to operationalise the concept. The model does not deliver precise predictions of changes in levels of economic activity. Rather it represents a policy tool for exploring long range issues, developing various scenarios and strategies. Applying the model to London enables the different challenges facing each of its 33 boroughs to be identified and appropriate policy responses to be developed, including implications for skills.

3.5 Focus on local forecasts

As noted above, during the late 1980s and early 1990s, the emphasis in many countries has switched to a more local focus. In part this was supply driven. Improved access to local data, combined with ever increasing computing power, made development of local projections, linked to a national macroeconomic forecast, both easier to conduct and cheap. Much local research has attempted to replicate what is done at national level. However, what is practicable is clearly constrained by the data available. There has also been strong pressure demanding such local emphasis and involvement, many practitioners regarding this as essential if the results are to have practical value.

In France, the emphasis since the early 1980s has increasingly focused on the Regional Employment and Training Observatory (OREF) as a mechanism for analysis of current and future training needs. These observatories have developed a range of methodologies for translating from sectoral change, through occupations and qualifications to training needs. Much of this remains quantitative in approach, but the idea that indicative economic planning of educational needs can be achieved, has been abandoned in favour of a more qualitative multi-disciplinary approach to such issues (Giffard et al. 1999).

Initially, most local projections were fairly rudimentary. A typical approach was to simply apply employment growth rates taken from a national or regional economic forecast to some base year estimates of employment in the lo-

cality. In the UK, for example, such procedures were formalised by IER in the early 1990s with the development of a software package for local forecasting (Wilson et al. 1995). This package was designed to be run on a PC by the local operator. It could be used to develop a variety of employment scenarios for the locality, linked to a particular national/regional forecast produced by IER on an annual basis. Detailed sectoral data for the locality were based on official data, distinguishing around 50 industries. Default employment forecasts for each sector were based on the assumption that the local sector maintained a fixed relationship with the corresponding regional employment figure. Occupational results were spliced on to this by extrapolating the local area's occupational structure within each sector in line with national or regional trends. Various options were possible to enable the user to customise the results, taking into account local quantitative and qualitative information. A similar package based on a spreadsheet approach was developed by Portsmouth Polytechnic (Brettell and Jaffrey 1990). This also included a Leontieff input output employment matrix, enabling rudimentary impact analyses to be conducted.

Rapid advances in computer technology and software, including the adoption of Microsoft Windows as a virtual standard, have facilitated the development of much more sophisticated approaches. In a joint operation with Cambridge Econometrics (CE), the IER developed the first version of the Local Economy Forecasting Model (LEFM) in 1993 (Wilson et al. 1995). This took the basic ideas embodied in the Fortec and the Portsmouth models forward on a number of fronts. The new package was designed to provide local users with a complete economic and labour market model for the local area, constructed as a mirror image of the models used by CE/IER at national level. LEFM provides a detailed disaggregated database, covering all of the usual economic and labour market indicators for the locality. These are all linked by the same kinds of technical and behavioural linkages which one would expect to find in a national model, including a full input output matrix. Corresponding data are also provided within the package for the region within which the local area sits and for

the whole of the UK. Links between the local area and the rest of the world are dealt with by modelling the flow of goods and services and of people across the local boundary. The package operates in a Windows environment. It has been designed to be transparent and easy to operate. The results produced are readily accessible and designed for input directly into written reports such as the 'local labour market assessments' which TECs were legally obliged to produce.

LEFMs have been set up for over 100 local areas in the UK since the model was first developed. The main clientele has been TECs. However, the package has also been supplied to local authorities, careers guidance companies and a variety of other clients. It has been used to produce the economic and labour market forecasts which lie at the heart of very many 'local labour market assessments' and related reports. Versions of LEFM have also been set up for countries outside the UK, including Germany and Spain. Emphasis on local forecasting has also been a feature of work in many other countries although this rarely has the same quantitative, model based, emphasis as the UK research.

4. Company level employment planning

4.1 Background

Companies and other employing institutions also have an obvious interest in monitoring their workforces and assessing the implications for recruitment of such factors as the age structure of the workforce, wastage rates, and changing patterns of demand. Indeed the genesis of national employment forecasting can be regarded as work carried out at individual company level. Company level 'manpower planning' (as it used to be termed or personnel planning to use a less sexist term) is now a well established management function. Larger companies and employing institutions often have a specialist personnel manager in quite a senior position to undertake this function.

At the company level, the range of models and methods is, of course, even broader ranging

from very simple rules of thumb to quite complex models paralleling the national level ones described above. These tend to focus more on the short-term than the national models, reflecting the different interests of governments and individual companies. The former are generally more concerned with the longer term development of the economy and the provision of education and training programmes, which involve long lags between entry and qualification. They are therefore much more interested in projections five to 10 years ahead. Companies, on the other hand, often tend to be more concerned with immediate problems connected with recruitment and wastage.

Where the focus is more upon the short term, the assumptions of fixed coefficients are more sustainable. However, the longer term the forecast being undertaken, the more important it is to recognise that such coefficients may be changing because of long-term trend influences as behaviour responds to changing economic circumstances.

There is an enormous literature covering these topics, much of which is far too specific to be of general value, given the aims of this particular review. Nevertheless, it is useful to provide a brief overview of some of the key issues.

4.2 Statistical methods in use

Bartholomew, Forbes and McClean (1995) give a comprehensive review of the various techniques in use to produce company manpower forecasts. This review greatly expands on the earlier work of Lewis (1969) in this area. A great deal of the literature is very mathematical in content, see Vajda (1978), and a large number of the papers appear in statistical or operations research journals. A good summary of the earlier work in company manpower planning is provided by Smith and Bartholomew (1988).

The starting point for most traditional company manpower models is the existing stock of labour resources and the wastage flow from their stock. The mathematics of Markov chains provide a ready modelling framework

for predicting such flows. As personnel record systems have improved and new statistical developments in survival analysis have evolved, semi-Markov processes in continuous time have become established. An age-specific approach can be used, rather than just a job tenure-specific method and this model is used to explore alternative scenarios, when an analysis of career patterns is taken into account. The demand side of manpower forecasting calls for a different approach because it is primarily concerned with jobs rather than people. There is no clear-cut demand model to set alongside the Markov processes which are used to model the supply-side, because the demand determinants at company level are very diverse, depending on the organisation.

Marked differences are apparent between the demand for employment in the traded sector (e.g. manufacturing companies) and the non-traded sector (e.g. local government or the health services). There is now a huge body of work about planning in areas such as health services, education services and government administration. Much of this is in the public domain. However, it tends to focus on sector specific concerns. The work in companies operating in the traded sector is extremely diverse. Much of it is highly technical and falls within the boundaries of operational research rather than the broader economic and social science which underlie the national work. A problem in this area is that much of this research is not made public because of concerns about commercial confidentiality.

Where the time series of data is long enough and of sufficiently good quality, regression modelling can be used. Alternatively, if information on causal variables is lacking, a simple trend extrapolation approach can be applied. In its more sophisticated form the autoregressive moving average class of models (ARIMAs) developed by Box and Jenkins (1970) may be used. A common problem at company level remains the relatively short time series of consistent data on which such models can be based. As databases of employment records have developed, opportunities to build better demand-side models for specific company occupations have increased.

4.3 Other methods used to project company demand

Reilly (1996) has recently described some more general and less quantitative approaches to assessing company employment demand. Amongst the methods are work study, which establishes optimal levels of resourcing for planning levels of operation. Associated with this technique, is activity analysis, that can be used to identify the numbers of employees needed for specific tasks. Both methods presuppose the company can accurately determine its future scale of operations from market output forecasts.

Other approaches which could be used are ratio analyses, which assume a fixed relationship between sales volumes and the numbers employed in specific occupations. Such an approach could be amended to allow for productivity growth. Another method is to use benchmarking, whereby staffing in comparable factories and offices is used as the criteria for determining appropriate employment levels.

In many smaller companies demand forecasting (both for output and employment) is achieved by subjective judgement of the senior managers. The criteria for making such judgements is never made explicit, so that forecasting errors cannot be reviewed and there is little opportunity to improve predictive performance from past experience.

4.4 Evaluation and improvements in company employment planning models

Commercial confidentiality shrouds many of the models produced by the corporate sector and so, it is not possible to assess how well they perform in terms of predictive accuracy. As the sophistication of supply-side modelling has increased, the prediction of changes in the existing stock of employees is likely to have become more efficient. Difficulties remain with the models for forecasting demand changes and it seems likely that the shortcomings in this area will be similar to those encountered for the national employment forecasting approaches (see Section 2.2).

Company employment planning models continue to be a valuable tool for the planning of human resources and the development of suitable training and education strategies. The literature continues to produce papers from many different countries which demonstrate the evolution of models used for forecasting employment at varying levels of aggregation. Two recent such studies are the papers by Khoong (1996) and Kao and Lee (1998).

5. The importance of the political, institutional and legal contexts

It is important to recognise that there are significant differences between countries in the approaches to these issues. These differences reflect both different cultural, historical and institutional backgrounds (which influence the general approach to such problems), as well as more specific differences related to data availability (which can constrain what is feasible). It is notable that the availability of good labour market data tends to be positively correlated with levels of national income and wealth. Although it is clear that the higher are national income levels the easier it is to afford what can often be quite expensive data collection and processing activities, a case can also be made that causality may run in the other direction. In other words good labour market information can improve the operation of the labour market and thereby contribute to economic growth and the creation of wealth.

This is certainly a major part of the rationale for the very substantial investments in this area made by the Department of Labor and, in particular, the Bureau of Labour Statistics in the USA. Although the USA is perhaps the classic example of a modern, capitalist economy, both the federal and state governments see fit to invest very heavily in data collection, modelling and forecasting. The situation in many of the richer European countries is similar although few make such large investments as the USA. In other parts of the world, such as the Tiger economies of the Far East, many governments are also

putting considerable emphasis on planning for investments in human capital.

The quantitative, econometric model building approach to anticipating skill needs has probably been most popular and been developed to the greatest degree in English speaking countries. However, many of the countries in northern Europe have also placed considerable emphasis on this approach, including France, Germany, the Netherlands and a number of Scandinavian countries. In a number of cases, they have built on the experience of countries such as the USA, adding their own particular characteristics, reflecting the national institutional framework and the statistical database in their country. In many respects, this has resulted in unique developments, but ones which, in principle have important lessons for other countries.

In the Netherlands, for example, the work of the Research Centre for Education and the Labour Market (ROA) (see, for example, Heijke 1994 and Borghans et al. 1998), has been very innovative. However, it is closely tied to the particular data available in that country, much of which is not collected in the same form elsewhere. The emphasis in ROA's work has been on providing detailed careers advice to individuals. This has shaped its methods and models, resulting in a very detailed emphasis on occupations and educational levels.

In a number of countries in southern Europe, (for example, Italy, Spain and Greece) data systems have not been established to enable the kinds of modelling work conducted in other countries to be carried out, (see, for example, Vergani and Muscella 1999 and Antonio 1999). The approaches adopted there are therefore more qualitative, and based on ad hoc surveys and other methods of obtaining data.

In the UK, the national government has also supported the development of employment forecasting, albeit not in quite the same manner or to the same degree as in the USA or Canada. It provides a good example of how institutional and other constraints influence the nature of the work conducted. The Depart-

ment for Education and Employment⁸ (DfEE) is the national government department responsible for labour market and related issues. It has for many years collected and analysed labour market data based on a range of different sources (unemployment statistics, estimates of employment vacancies, pay and other key labour market indicators)⁹.

The DfEE itself carries out some of the analysis of labour market data, but it has a long history of commissioning research on the labour market, including forecasts of future labour demand. Academics and commercial consultants have undertaken this work. In particular, the Institute for Employment Research (IER) received support for developing and running a sophisticated econometric model of the national economy over many years, starting in 1975. This resulted in the production by the IER of an annual review of the economy and employment which looked at future trends in the labour market. This programme of work is described in Figure 2 above. The UK National Skills Task Force has recently recommended that such work be carried out on a regular biennial basis, supported by public funds¹⁰.

⁸ Formerly the Department of Employment.

⁹ These are collated and published in *Labour Market Trends* (formerly *The Employment Gazette*) and related publications. In addition, the DfEE is responsible for commissioning the labour force survey (LFS) as well as various other evaluations of specific training programmes and policy initiatives. As in other European countries, the LFS was instigated in response to the need to provide statistical data for the European Commission. More recently, it has developed into one of the major sources of labour market data, which is widely used by a vast range of analysts as well as government officials.

¹⁰ There are, therefore, a variety of well-established mechanisms for analysing, identifying and forecasting labour market trends and skill needs in the UK. However, the reliability of estimates based on some of the national surveys (often adjusted to reflect regional conditions) may be questioned. Moreover, the fragmentation at local level means that the quality of information can vary a great deal from one locality to another. The position, in general, remains less well developed than in the USA.

6. The importance of statistical infrastructure

In addition to investment in general economic modelling techniques, through support of research in universities, various national governments have also provided technical support for anticipating skill needs in a number of other ways. The key elements here have been:

- the development of standard systems of classification;
- the introduction of regular national surveys of households and employers;
- the development of means of access to these datasets electronically.

In many countries attempts have been made to develop standard systems of classification for both occupations and qualifications. Such systems are an essential prerequisite for the development of the sound statistical databases which in turn are basic building blocks for robust modelling and forecasting work.

In the USA the current focus of attention is on developing systems for classifying generic skills such as numeracy, literacy, problem solving, social skills, etc. Such developments are in hand in the UK but at a less advanced state. Other European countries, including France, Germany, the Netherlands and Sweden, have seen similar developments.

Sectoral information lies at the core of most macroeconomic models used for employment forecasting. This requires data on employment, of course, but also a range of other data if a fully specified macroeconomic model is to be developed. In most countries, where they are available, such data are based on surveys of establishments. A key issue is whether such data are available at regional and local levels. Without such information development of subnational models and forecasts is greatly constrained. Some countries are well served with regard to such data. The BLS in the USA, for example, conducts a range of very detailed sectoral and occupational surveys. In Ger-

many the *Mikrozensus* (labour force survey) and the establishment panel provide key inputs (cf., for example, Dostal 1999 and Bellmann, in this report).

Until recently, information on occupational structure was, in many other countries, only available from the Census of Population which is usually only conducted rather infrequently (typically every 10 years). For example, until the European labour force survey (LFS) was properly established, with reliable information on occupational employment, the main source of data on this topic in most European countries was the Census of Population (CoP). Other surveys may have contained occupational data but this was not their central purpose and they were inappropriate for many reasons. Even today there are severe problems of comparability both over time and between countries, despite moves towards the use of international standards such as ISCO. Perhaps the most problematic feature has been the lack of a standard system for classifying occupations. Considerable efforts have been made in many countries to standardise such systems across all major surveys, but at present the differences between countries remain significant.

The European LFS is conducted in a broadly similar fashion in all the countries of the European Union. The gradual improvement in the European LFS, and in particular its recent increase in sample size, mean that it is now a prime source of data on occupations. However, it is still limited in its ability to provide accurate data for small geographical areas. Compared to the huge survey of establishments conducted by the Bureau of Labour Statistics (BLS) for the USA, the European LFS provides a very fuzzy and erratic picture of trends in occupational structure. Further improvements will be needed here if models comparable to those described for the USA are to be developed across Europe.

Other data sets also need to be made more accessible and to move towards a standard system of classifying occupations. Such developments could dramatically improve the ability of researchers to monitor trends in occupational and related matters. However,

surveys available in most European countries remain inadequate compared to the much larger surveys conducted by the BLS in the USA which provide a much more accurate picture of skill mix and occupational earnings within sectors.

A major development in making labour market information (LMI) more accessible has been the introduction of systems such as the American Labour Market Information System (ALMIS)¹¹. Such national systems, funded by the government, are designed to allow analysts and others direct access to various datasets containing labour market information, via the internet. These datasets include censuses of population, surveys of employers, household surveys and surveys of earnings. The availability of ALMIS in the USA has led to a vast expansion of activity related to the processing and dissemination of LMI, including the development of a range of commercial services aimed at providing a forward look at the labour market, and an enormous growth of activities based on accessing, processing and disseminating these data.

7. Problems in labour market forecasting

It is important to recognise the limitations of what can be achieved using current best practice methods. Even the most sophisticated models available suffer from a range of problems. Some of these are, in principle, things which might eventually be solved. Others are likely to remain intractable for the foreseeable future. These problems can be discussed under three main headings:

¹¹ Similar systems have been developed in some European countries. The equivalent in the UK, for example, is the National Online Manpower Information Service (NOMIS). In the UK charges are imposed for access to these data, with different rates for commercial and academic use. NOMIS allows detailed data to be obtained for quite small geographical areas, such as local authority districts (of which there are almost 500). However, there are some limits imposed by DfEE because of reasons of confidentiality as well as other constraints imposed by considerations of statistical reliability.

- a) limits to understanding,
- b) data inadequacies,
- c) methodological difficulties.

7.1 Limits to understanding

The world is a very complex place. Most socioeconomic variables are the outcome of the decisions and actions of many different individuals and institutions. Chance factors, acts of God, in addition to well laid plans influence the eventual outcome. In developing models to explain behaviour, the objective is to identify and isolate the key factors which are held to affect the variable of interest. This is often much easier said than done. It is often quite difficult to disentangle the various influences which are thought to be important.

Most models are set up on the basis that behaviour is fixed. This itself may be a questionable assumption, especially in the social sciences. Behaviour may alter in response to new events or changes in exogenous variables (that is variables whose own determination lies outside the system being modelled). In some cases behavioural relationships may lie hidden because previously unexperienced influences come into play. A good example of this was in macroeconomic models used to explain aggregate consumption during the 1970s. These failed to include inflation as an explanatory variable until inflation reached significant levels in the 1970s. Inflation had always been a potential influence but its effect remained hidden while it was not at a high level. Until this was recognised by the modellers, their models produced biased forecasts.

In producing any particular forecast a view must be taken about any exogenous factors that may be important. For example, government policy is frequently regarded as exogenous because of the difficulties in modelling the political process. This does not mean to say that such matters are unimportant. Typically, the sensitivity of the forecast to alternative assumptions about such matters is assessed by developing a range of scenarios rather than just a 'fixed point' forecast. Major economic traumas in the rest of the world economy may need to be dealt with in a simi-

lar fashion. Few national employment forecasters attempt to model explicitly what is going on in the world economy, even though it may be a key driver of domestic employment.

Some other, non-economic events, such as earthquakes, may also be regarded as 'unforeseeable' in the context of forecasting the labour market. Such 'acts of god' are regarded as inherently beyond the understanding of the model (although in another context geologists may make serious attempts to forecast such events).

7.2 Data inadequacies

A major problem area in much forecasting work relates to data. This may reflect lack of data on key variables, for example, accurate and detailed data on occupational employment and occupational earnings, as well as many important labour market inflows and outflows. It may also reflect inadequate data in terms of timeliness, accuracy and fitness for the purpose it is being used. Frequently the data available are lacking (for example, labour market flows). Often they have been collected for a different (often administrative) purpose and are therefore less than ideal for the development of a forecasting model. There is no substitute for good quality, regular information. Unfortunately it is often not until model building has begun that it is possible to accurately identify data requirements. In the first instance, of course, it is necessary to do the best one can with whatever data are available. Data problems remain a key constraint to the development of employment forecasting tools in many countries. While a few, such as the USA, have very good systems, many others, including many European countries have to muddle through using what limited data are available. In other countries, even the basic data needed to build detailed multisectoral models (such as detailed measures of sectoral output and related economic accounts) remain a dream.

7.3 Methodological difficulties

Econometricians have identified a whole series of methodological problems in the devel-

opment of time series models. This is not the place to go into such issues in detail. For this, the reader is referred to a standard econometrics textbook. However, it is helpful to rehearse some of the main problems. One class of problems comes under the heading of multicollinearity. Most variables in economics are highly trended it is therefore often very difficult to disentangle the separate influences of different -variable. It is also too easy to discover spurious relationships which simply reflect the fact that two unrelated variables are both trended (and therefore closely correlated) while in reality there is no relationship between them. A second class of problems relates to simultaneity. Variable X may depend on Y but Y may also depend on X. Technically Y is said to be an endogenous variable, that is a variable determined within the system that is being modelled. This contrasts with an exogenous variable which is entirely determined by factors outside the system being modelled. Considerable care is required in such circumstances if misleading inferences are not to be drawn. It is of course a truism that nothing is truly exogenous and that everything depends upon everything else. The trick is to identify which are the essentially exogenous variables in any system and which need to be treated as simultaneously determined.

Various other technical pitfalls await the unwary forecaster, such as serial correlation, heteroskedasticity and omitted variable bias. This is not the place to discuss such matters in detail. Suffice it to say that in developing a satisfactory forecasting model, due consideration needs to be given to avoiding falling into such traps, if the forecasts are not to mislead rather than guide policy-makers.

There have been numerous methodological advances in this area in recent years which have been aimed at addressing these technical problems. However, it is probably true to say that these lessons have yet to be fully implemented in the practices of most labour market forecasters. However, this is not a reflection of the failure of such analysts to recognise the need to improve their methods so much as the difficulty of applying these new techniques when dealing with so few time series observations.

8. Conclusions

8.1 Forecasts – Who needs them?

The world is an uncertain place. In this context, almost everyone is involved in planning and forecasting, even if this amounts, in practice, to assuming implicitly that there will be ‘no change’. It has been argued by employment forecasters, that since some forecasting of the labour market is inevitable, it is better that they be done in a logical, consistent and systematic fashion. There is a large body of opinion that such forecasts can be of value to a broad range of potential users within a particular geographical area, be it a national economy or a much smaller local area. At one level are policy makers charged with the responsibility of setting the institutional framework and delivering government policy. At another level are those concerned with providing goods and services, including education and training programmes. Employers, educationalists and, of course, individual students and workers themselves, all have an interest in trying to peer into the future and to ensure that their own decisions result in the best possible outcomes (however these might be defined)¹².

Forecasts can therefore be seen as having two prime roles: first to guide policy decisions made by the government and its representatives; and second, as a general aid to the individual actors operating within the labour market, providing them with information which can aid their own decision making. The degree of emphasis on these two elements differs quite significantly between countries.

Against this view must be set opinions of the smaller but at times vociferous group of critics, who have decried the value of such activities. They have argued, variously, that it is unnecessary, impossible and /or irrelevant to carry out employment forecasts. In many cases, however, their criticisms have been

constructive and have led directly to improvements in methods and approaches used, including the development of more qualitative methods. In other cases the practitioners have argued, convincingly in the opinion of the present author, that the criticisms are invalid. The fact that considerable efforts to conduct such forecast are going on all over the world suggests that, on balance, such activities are generally regarded as very useful and are perceived as having real value.

8.2 Accuracy and limitations of forecasts

It is important, of course, to have a clear appreciation of the limitations of any forecast. Forecasters do not have a crystal ball and cannot foresee the future precisely. Nor are they concerned to ‘plan’ in an indicative sense. Rather, they try to map out the consequences of a series of assumptions about patterns of behaviour and policy stances for likely future developments.

As set out in Section 7 there are severe limitations in our ability to forecast. These include:

- ❑ data problems – there is often considerable difficulty in establishing the current position let alone forecasting the future. These difficulties may be especially acute at local level;
- ❑ limits to understanding – although the social sciences have made considerable strides over recent years there are still major gaps in our knowledge about how systems and individuals behave;
- ❑ past behaviour may not always be a good guide as to how things will develop in the future;
- ❑ there are technical difficulties in forecasting which are often ignored due to data limitations (multicollinearity, serial correlation, simultaneity bias, etc.);
- ❑ a final set of problems relates to the fact that many events are inherently unpredictable (such as earthquakes or other acts of god, political events, etc.).

¹² This information may need to be processed and moderated by careers guidance counsellors in order to be of value in making individual training and career choices.

8.3 The benefits of conducting forecasts

The production of a formal forecast or set forecasts for a particular area should not be seen as an end in itself. Rather it is best regarded as part of a process of improving understanding about what is going on in the economy and the associated labour market. This understanding can then guide policy makers and other actors operating within the local economy (such as individual workers, students and employers) to better decisions. The main benefits can therefore be summarised as follows:

- ❑ the aims and objectives of intervention can be made clearer and the ability to evaluate policy can help to establish a virtuous circle;
- ❑ forecasts can provide a focus for discussion and cooperation ('posing questions') and may help to breakdown old misperceptions about labour markets;
- ❑ forecasts should enable those involved to take a more strategic, rather than a fire-fighting, approach to problems as the implications of current trends and outcomes for the future are explicitly explored;
- ❑ finally, forecasts can also provide important information and guidance to individuals enabling them to make better decisions about their own futures, although this may need to be moderated by expert careers guidance counsellors to be of most value.

8.4 Preferred methodologies

A number of different approaches have been adopted to anticipate changing skill needs. The traditional approach has usually involved formal, quantitative methods. More recently, other, rather less formal methods have been developed which have a strong qualitative emphasis. Often this has reflected problems or lack of key data. However, many exercises nowadays involve a mixture of both quantitative and qualitative methods, which are regarded as complementary.

With regard to quantitative methodologies, on the demand side, best practice increasingly involves more sophisticated econometric techniques, enabling quite complex behavioural models to be developed. Often this is now employed in conjunction with surveys of employers, asking them more or less directly about their future skill needs. Until recently, the latter had fallen into disrepute but is currently seeing something of a revival, albeit in a modified form.

On the supply side the main methods used usually involve a stock-flow approach. This projects future stocks from current levels by predicting inflows and outflows. In the early models this was usually done on the basis of assuming fixed rates of flow based on past data. However there is much evidence accumulating that such flows are dependent on economic and other variables. The focus of such models tends to be on the existing workforce, inflow rates and wastage rates. Better data are now becoming available enabling something approaching a full set of demographic accounts to be developed in some countries at the leading edge of such work. As such data are improved, this will facilitate the modelling of transition rates between the numerous states of training, employment, unemployment, etc.

Although the present review of the main forecasting methodologies suggests that a behavioural model is the most appropriate approach (which should, in principle, enable a better understanding of the main factors influencing the supply of and demand for skills), more basic time series models may also provide a useful supplement in situations where data limitations preclude the more sophisticated approach.

Most recent work has emphasised the need to consider replacement demands and not just to focus on projected levels of employment¹³. In addition, other more qualitative methods, involving surveys, case study work, focus

¹³ Although this has been done in some countries such as Germany since the 1970s, albeit not always in a detailed breakdown by single occupations or fields of study.

groups and other techniques have all been found to have the potential for 'adding value' to the more traditional methods. A key feature of much recent work has been the focus on key or generic skills which go beyond the straight-jacket imposed by traditional occupational classifications, to look at the skills needed to do various tasks.

8.5 The importance of the political and statistical infrastructure

When comparing the different approaches used to anticipate future skill needs in different countries, it is clear that the political, institutional and legal context, have had a crucial influence. In part, this is reflected in the statistical infrastructure within which the analyst has to operate. The latter has a particularly important influence. Without good data it is impossible to build some of the more sophisticated models. Statistics are of course only part of the story. The development of macro-economic and labour market forecasting models is a very slow and expensive business. Most of the countries where fully developed systems are in operation have invested very heavily in such activities over a period of many years. While new IT developments mean that it is now much easier to duplicate such effort and possibly to 'piggy-back' on what other countries have already achieved, it is less easy to suddenly invent a long time series database, which lies at the heart of most models.

The impact of IT in this area has been immense. In the USA the development of ALMIS the American Labour Market Information System has facilitated all kinds of research and commercial activities in the area of LMI and labour market forecasting. This has also been a feature in some European countries. For example, the DfEE has supported the development of the equivalent UK National Online Manpower Information System (NOMIS). This provides online access to labour market information via the internet to anyone with the appropriate technology. It includes all the major data sets for which DfEE is responsible¹⁴. This has led directly to

¹⁴ Charges are made for accessing these data and there are strict controls to ensure confidentiality.

the development of many new local products and services.

8.6 Increasing emphasis on local forecasting

In recent years, there has been an increasing tendency towards devolving power to smaller geographical units in many developed economies. This has led to an increased demand for labour market information (LMI) and, in particular forecasts, at local level. As the perceived need for information at local level has grown, so the capacity of the databases and the power of equipment required to process data have increased. The information revolution has gathered pace over the 1980s and early 1990s and analysts and policy-makers now face the prospect of an enormous increase in the amount of information available. Data are becoming more easily available in many ways, with the introduction of on line databases, the increasing ease with which large survey databases, such as public censuses, can be accessed and the growing power of computers to process this information.

However, in some respects, there is a danger of being overwhelmed by the mass of data available and a key problem is to avoid information overload and to sort out the key messages. As at national level, local forecasts are intended to identify the key trends and to highlight the main issues that will be important in the future. In these circumstances, analysts have begun to develop tools, which bring together relevant information about the local economy and present it in an easily digestible form. At the same time, these tools can draw out the implication for the future of continuation of past trends as well as enabling 'what if' scenarios to be developed. A basic aim is to convert basic labour market information into useful intelligence, which can be used to guide important decisions. Another objective, in many cases is to empower the local analyst by providing them with the tools to undertake their own forecasts.

8.7 Main policy conclusions

The main policy conclusion from this review is that employment forecasting *can and does*

provide a useful aid to policy-makers in making decisions about training, recruitment and the personnel issues. It can also provide very useful information to a broad range of other actors in the labour market. This includes employers, education and trainer providers as well as individuals, although the need for such information to be moderated by careers guidance counsellors and others is strongly emphasised in many countries.

However there are strong limitations to what such exercises can do and it is clear that they do not offer a crystal ball from which the precise details of the future can be gleaned. Rather they spell out the implications of a series of assumptions about future developments based on certain relationships representing a continuation of past patterns of behaviour. Appropriately done, they can provide a transparent, logical, consistent and systematic view of what the future might look like given these assumptions.

The value of such exercises depend crucially on the quality of the data upon which they are based, as well as the validity of the various assumptions built into the forecasts. To some extent the latter will depend upon the degree of sophistication of the models adopted, the more sophisticated the model the more likely it is to be able to deal with the many and subtle influences on changing employment structures. Naive, mechanistic models are, unless used very carefully, likely to mislead rather than inform. On the other hand, increasing detail, complexity and sophistication of some models can rapidly run into decreasing returns, unless backed up by data and analysis of equivalent quality. Increasing detail and complexity can also reduce transparency. It also makes it less easy to

identify simple causes and effects, as for example, in econometric models with several thousands of equations. Some forecast evaluations suggest that 'native' models, at a more aggregate level, are not necessarily of lower accuracy than more complex and detailed ones.

It is also important to emphasise the many problems and difficulties that face many forecasting exercises of the kind reviewed here. Gaps and inadequacies in the database set limits on what is feasible. Methodological problems further compound the difficulties that the forecaster faces. The sheer complexity of the real world and the difficulty of identifying and isolating the key influences on the supply of and demand for skills must not be underestimated. A major reservation on forecasting is that despite all the effort on forecasting activities since the 1960s and 1970s, this has not been able to prevent unemployment and over-education. The jury remains out on whether this is because of the inadequacies of the projections themselves, or whether it reflects the fact that policy makers and others have ignored them (or possibly failed to act appropriately).

Despite all these caveats, the experience of many countries outside Europe, particularly the USA, suggests that useful forecasting tools can be developed at European level. This experience suggests that such forecasts can provide helpful information to both labour market participants as well as for policy-makers about the labour market environment they are likely to face. It is therefore recommended that the possibility of developing a regular European-wide labour market assessment, including detailed occupational forecasts, be given serious consideration.

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