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SKILLS ANTICIPATION
BACKGROUND NOTE
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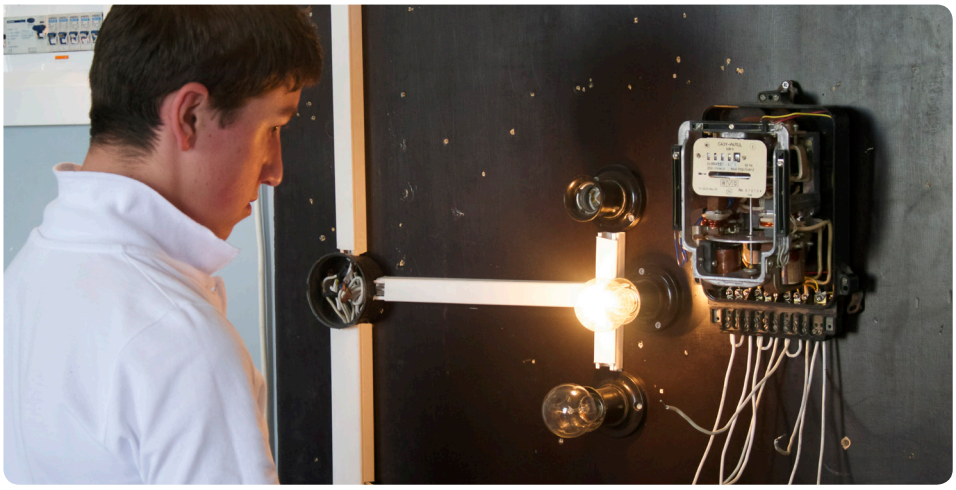
SKILLS FORECASTS

MATCHING THE RIGHT WORKERS AND SKILLS WITH THE RIGHT JOBS



In a context of dynamic and complex labour markets, matching the right workers and skills with the right jobs becomes increasingly difficult. Skills forecasting is one way to identify future imbalances between labour supply and demand. Sometimes called 'labour market forecasting' or 'employment forecasts', this methodology aims to make predictions about future imbalances in supply and demand by producing a comprehensive picture of future labour market developments in terms of economic sectors, occupations, qualifications and skills.

Typically, a **forecast exercise** tries to answer three questions:

- Where will the jobs of the future be concentrated in the country (or sector or region)?
- What are the implications of this for skills needs, as measured by occupation and qualification?
- How does this compare with developments in the supply of skills?

A forecast acts as an early warning mechanism to help to alleviate potential labour market imbalances and support different labour market actors to make informed decisions. Its key assumption is that the patterns of performance and behaviour in the economy and labour market will reflect past trends and that there will be no major disruptions to the economy. Its reliability is thus dependent on the concept that the past is a good predictor for future developments, and the forecasting team's skills to adjust and interpret past developments into likely future scenarios.

Although no-one has a crystal ball that can predict the future with precision, many trends are robust and can be used to inform all involved about the world they are likely to face. Starting with certain assumptions based on the available experience, knowledge and judgment, estimates can be projected into the coming years using different methods and approaches. However, a forecast cannot predict radical disruptions or sharp deviations from the past. Therefore, the results should not be considered a precise view of what will happen. Rather, they indicate a likely future, given a continuation of past patterns of behaviour and performance.

Contents

TYPES OF FORECAST METHODOLOGY

Forecasting is done by developing a 'mathematical model' that provides a simplified representation of reality that can help in understanding a topic (in this case changing patterns of the demand for skills in the labour market). A 'model' reduces the complexity of reality into a predictable/ foreseeable future. The more complex it is, the closer to the reality, but more difficult to manage/ conduct forecasting.

Two steps of developing a model are: (i) collecting long-time series data of past trends in economy, labour market, demography, education, etc. (ii) making assumptions on the future of economy, labour market, demography, education.

Social science models are typically built using quite sophisticated statistical and econometric techniques, and use data drawn from largely official sources. Forecast models can vary according to the methodological approach adopted (types of model used, emphasis on econometrics as opposed to other techniques); as well as the coverage of projections (geography, sectors, occupations (including replacement demands), qualifications, other aspects such as generic skills, gender, employment types). Different approaches can be used in forecasts, combining both quantitative and qualitative methods (Table 1).

Differences of methods primarily stem from data availability, quality and reliability (which can constrain what is technically feasible), but also from different cultural, historical and institutional backgrounds across countries.

For many years, the dominant forecast technique has been quantitative modelling, typically using a combination of behavioural/ econometric models and more basic extrapolative techniques. The latter are used when there is not adequate data to apply more sophisticated methods.

An important building block in quantitative forecasting is macro models. There are many established national and international macro models that have been developed for various purposes. A multi-sectoral dynamic model (MDM) is a highly disaggregated macro-econometric framework for generating forecasts and alternative scenarios, analysing changes in economic structure, growth and fluctuations over the medium and long-term1.

Over time, modelling techniques have been improved by the increased availability and accessibility of data, methodological advances and increased computing power.

As a result, computable general equilibrium (CGE) models are increasingly used to analyse the economy-wide effects of events such as climate change, tax policies, and immigration.2

The components of skills forecast are supply (e.g. labour stocks, flows, education choices); employment change (e.g. employment estimates by sector, occupation, qualification; expansion or contraction) and replacement needs (permanent/ semi-permanent withdrawals from the employed workforce). Typically, the time horizon can vary from 5 to 20 years. The advantages of forecast exercises are their comprehensiveness (usually covering all sectors), consistency and transparency, based on clearly defined quantitative scenarios.

TABLE 1: METHODS AND APPROACHES USED IN FORECASTS

QUANTITATIVE METHODS	QUALITATIVE METHODS
▪ Mechanistic/ extrapolative techniques ▪ More complex time series models ▪ Behavioural/ econometric models ▪ Survey of employers' opinions ▪ Skills audits	▪ Delphi techniques (expert opinion/consultation) ▪ Case studies ▪ Focus groups ▪ Holistic modelling approaches ▪ Scenario planning

1 MDM was developed for economic policy analysis of the UK economy by the Cambridge Growth Project. As it disaggregates industries, commodities, and household and government expenditures, as well as foreign trade and investment, it can be used to investigate the effects of policies on individual sectors of the economy as they vary through time. It can also simulate the effects of changes at a sector level on the whole economy and its implications for policy.

2 Computable general equilibrium (CGE) models are a class of economic models that use actual economic data to estimate how an economy might react to changes in policy, technology or other external factors. They are often micro founded on assumptions about preferences, technology, and budget constraints.

FORECAST IMPLEMENTATION

Future skills needs depend on the types of jobs that the economy creates, which in turn, depend on macro-economic developments in domestic and global economies. Therefore, a forecast starts with macro-economic projections that will provide an indication of future employment levels across economic/ industrial sectors. From the earliest practices, most forecasts adopted a multi-sectoral and model-based quantitative approach in three steps:

- First, **macroeconomic projections** of the likely changes in industrial employment are made in a multi-sectoral, dynamic macroeconomic model (MDM) or a computerised general equilibrium model (CGE). Examples of national and international macro models include the macro model E3ME of the Cedefop skills project[3] and Hermin model which is more suitable in countries which lack statistical data. These macro models use the national accounts (NA) and regional/ local accounts (if available), economic input-output tables, and other economic datasets[4].
- Second, **projections of the occupational structure** of employment within each sector/ industry are made using the data of population census and labour force surveys. The overall changes in aggregate occupational structure can occur through a combination of shifting patterns of sectoral employment structure and the changing occupational composition of employment within sectors. Therefore, the level of employment in a particular occupation can change: either because the sectors in which it is concentrated grow or decline, or because of changes in occupational composition within sectors. In addition to the projected increase (or decrease) in occupational employment levels, there is also need to replace those leaving an occupation because of retirement or other reasons (replacement demand).
- Third, **labour supply is calculated based on the demographic trends and projections** (population census), plus changing patterns of qualifications (education/ training data; enrolment and completion rates of different education levels and types) in the country.

Faced with problems of data availability and quality in transition and developing countries, simpler models have been used; e.g. input-output models. These are simpler and less data-hungry models based on input-output tables or social accounting matrices to demonstrate how a specific scenario on the demand side – for example higher demand for some

TABLE 2: CLASSIFICATION OF ECONOMIC ACTIVITIES BY ISIC REV.4 AND NACE REV.2

	Sections	ISIC REV.4 / NACE Rev.2 Description of economic activities
1	A	Agriculture, forestry and fishing
2	B, C, D, E	Manufacturing; mining and quarrying; and other industry
2a	*C*	*Of which: manufacturing*
3	F	Construction
4	G, H, I	Wholesale and retail trade; transportation and storage; accommodation and food service activities
5	J	Information and communication
6	K	Financial and insurance activities
7	L	Real estate activities
8	M, N	Professional, scientific and technical activities; administrative and support service activities
9	O, P, Q	Public administration, defence; education; human health and social work activities
10	R, S, T, U	Other services

3 E3ME is a well-established model of the European economy and labour market. For more info, see the E3ME website: http://www.e3me.com

4 For example, the UK uses the Cambridge Econometrics' MDM-E3 model, which assesses the prospects for the UK economy based on the likely path of global economic growth, global exchange rates, the government spending and interest rates.

products or services by households, a change in direct foreign investment, or a change in government spending – will influence the volume and structure of employment and, the demand for education and skills[5].

To allow a proper interpretation of data gathered through the forecast exercise, it is essential to use standardised systems of classification for economic sectors, occupations and qualifications. These allow a combination of different data sources and define the level of detail that can be achieved. For the classification of economic activities, either the International Standard Industrial Classification (ISIC Rev.4) or the NACE Rev.2[6] are widely used, both nationally and internationally. In both systems, economic activities are divided into 10 or 11 categories at high-level aggregation (Table 2), while they are divided into 38 categories at intermediate aggregation.

For the classification of occupations[7], the International Standard Classification of Occupations (ISCO-2008) is used widely from one-digit to four-digit classification. A newly developed alternative to ISCO is the European Skills, Competences, Qualifications and Occupations (ESCO) within the European Union, but it is still a work in progress[8]. For the classification of qualifications, the International Standard Classification of Education (ISCED-2011) is commonly used[9]. In other cases, the levels of European Qualifications Framework (EQF) or national qualifications framework are used as an alternative to ISCED. Table 3 shows approximate correspondence across the classifications of occupations, qualifications and skills.

TABLE 3: APPROXIMATE CORRESPONDENCE ACROSS THE CLASSIFICATIONS OF OCCUPATION, QUALIFICATION AND SKILL LEVELS

Main Occupational Groups (ISCO-2008) Only 1-digit level	Approximate correspondence to qualification levels		Approximate correspondence to skill levels
	ISCED 2011	EQF	
1. Legislators, senior officials and managers	ISCED 8, 7, 6, 5	EQF 8, 7, 6, 5	Higher skills *(tertiary education)*
2. Professionals			
3. Technicians and associate professionals			
4. Clerical support workers	ISCED 3, 4 can be also ISCED 5	EQF 3, 4 can be also EQF 5	Intermediate skills *(upper secondary education)*
5. Service and sales workers			
6. Skilled agricultural, forestry and fishery workers			
7. Craft and related trades workers			
8. Plant and machine operators, and assemblers	ISCED 1, 2, 3	EQF 1, 2, 3	Low skills (below upper secondary)
9. Elementary occupations			

5 OECD regularly publishes input-output tables for a number of countries. For more info see: www.oecd.org/sti/inputoutput

6 NACE is a four-digit classification providing the framework for collecting and presenting a large range of statistical data according to economic activity in the fields of economic statistics by Eurostat.

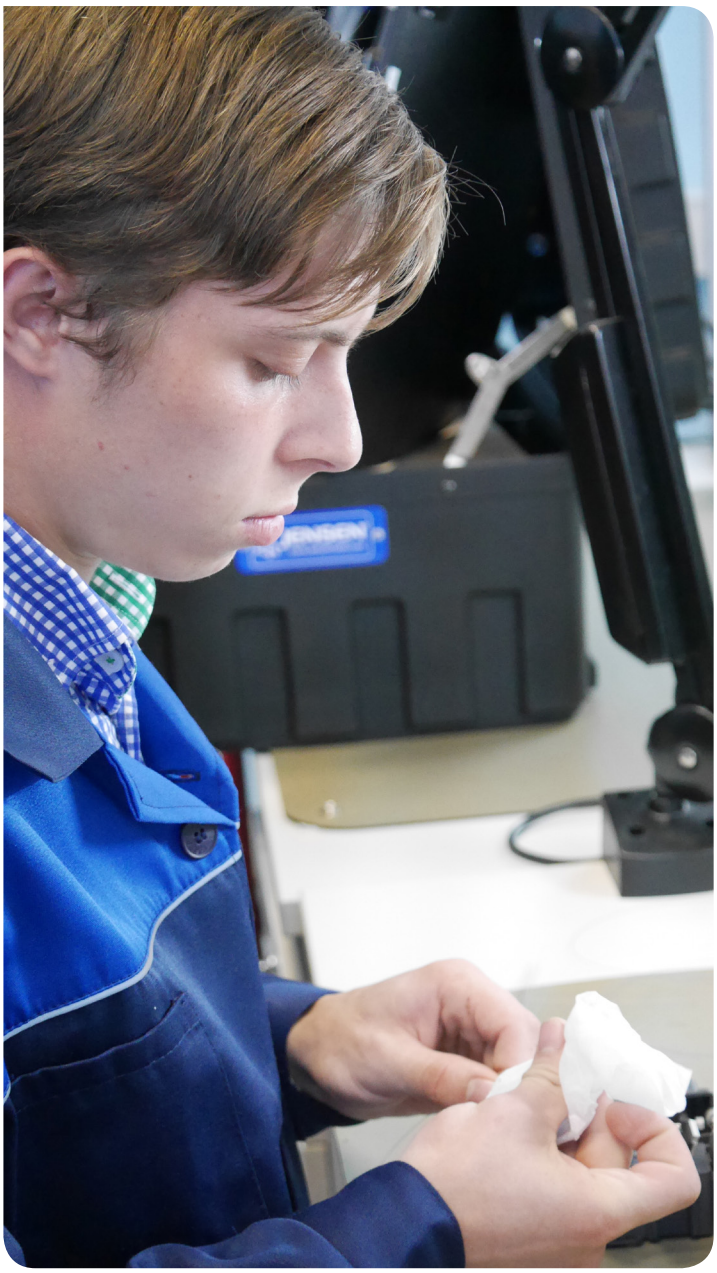
7 An occupation is defined as a set of jobs whose main tasks and duties are characterised by a high degree of similarity.

8 For more information, see https://ec.europa.eu/esco/portal/home

9 According to ISCED-2011, these are the education levels: 1-Primary, 2-Lower secondary, 3-Upper secondary, 4-Post-secondary non-tertiary, 5-Short-cycle tertiary, 6-Bachelor or equivalent, 7-Master or equivalent, 8-Doctoral or equivalent.

SUCCESS FACTORS

Forecast predictions will deviate from reality if the assumptions are flawed. The quality of predictions can be low due to: (i) Data problems (e.g. lack of or incomplete data, quality issues, lack of long time series), (ii) Wrong and/or changing assumptions (e.g. overly optimistic or pessimistic scenarios), (iii) Unexpected changes and/or radical disruptions (e.g. sharp deviations from the past).



Forecasting is a resource-intensive process, requiring substantial prior investment in regular data production and analyses. The existence of regular and reliable data (e.g. national accounts, population census, labour force surveys, establishment census) and electronic access to these datasets are vital. They are mostly official data sources produced by statistical institutes, but gathering and harmonising all datasets requires extra work due to frequent changes in the classifications and definitions used in the datasets. The lack of good quality, reliable, regular and detailed data on occupational structure within sectors is often a problem, it might be necessary to first develop a long-term series on employment by industry (economic sector), status, region and occupation. In summary, data quality is key since the forecast results cannot be more robust than the data upon which they are based.

'Best practice' forecasts generally involve quantitative methods, based on the use of large scale, multi-sectoral models to produce a comprehensive overview of how structural economic and technological changes affect the demand for skills. However, such methods need to be complemented by other quantitative and more qualitative methods, especially where data for building quantitative models are limited. By including alternative scenarios and varying underlying assumptions, different forecasts can be produced. These variants allow a deeper analysis of the underlying factors influencing an economy. Once developed, the first model is just starting point for trial. The model remains 'alive' for a continuous update based on new developments. Keeping the same model and continuously improving it over time is crucial for success.

Another success factor is the need to build up a network of producers, stakeholders and users of the forecast results (economic sectors, policy makers, learners). Having this network is crucial to follow up on data gathering, i.e. to use the data to really shape the policies. In this way skills forecast can be institutionalised and the results used more effectively through regular discussions of labour market developments among relevant stakeholders.

TYPICAL INSTITUTIONS/ ACTORS INVOLVED

Most forecasts are conducted by independent research institutes or university centres, specialised in econometric research. Sometimes the statistical offices or the ministries of economy and labour are involved in forecasting, but the role and data of statistical offices are always vital whether they are directly involved or not. The forecasting exercise is generally commissioned to research institutes by public institutions (ministries of economy, labour, education, or VET), social partners or semi-private institutions (agencies, employer associations, state councils or commissions).

EXAMPLES

Cedefop (the European Centre for the Development of Vocational Training) carries out a pan-European Forecasting Model which uses the macroeconomic model (E3ME) developed by Cambridge Econometrics and employment projections of the Warwick Institute for Employment Research (IER). It provides comprehensive information on future labour market trends in Europe, including projections on labour force, employment trends and job opportunities. For more information, see http://www.cedefop.europa.eu/en/themes/identifying-skills-needs or http://www.cedefop.europa.eu/en/events-and-projects/projects/forecasting-skill-demand-and-supply

United Kingdom: Employment forecasts are carried out by the Warwick Institute for Employment Research (IER) at Warwick University, based on the macroeconomic forecasts of the Cambridge Econometrics (CE). They are commissioned by the Sector Skills Development Agency (SSDA) or UK Commission for Employment and Skills (UKCES). IER was the first research group in Europe to produce regular employment forecasts. For more information, see http://www.warwick.ac.uk/fac/soc/ier, http://www.ssda.org.uk, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/514285/Working_Futures_Headline_Report_final_for_web__PG.pdf

Ireland: The Irish occupational forecasting model has been developed by the Economic and Social Research Institute (ESRI) at the request of the Training and Employment Authority (FAS). For more information, see http://www.esri.ie

The Netherlands: The Research Centre for Education and the Labour Market (ROA) within the Maastricht University has developed the Dutch forecasting model. For more information see http://www.fdewb.unimaas.nl/roa

Czech Republic: Occupational forecasting models from the Netherlands (ROA) and Ireland (ESRI) were adapted to the needs of the Czech Republic. In 2001 for example, limited time series for the period 1993-1999 were used in order to provide forecasts for the period 2000-2004 for 50 occupation groups and 59 educational categories for expansion demand, replacement demand and job openings by the National Observatory of Employment and Training. For more information see http://www.nvf.cz/observatory/gb/info_gb.htm

France: Employment forecasts are currently carried out at national, sectoral and local level, with different bodies responsible for the forecasting activity in each case. At national level, the Institute of Economic Forecasting (BIPE) carries out forecasts, at local level the Regional Employment and Training Observatories (OREF) is involved, while the Statistical and Economic Research Department of the French Ministry of Employment produce quantitative employment projections. For more information, see http://www.bipe.fr/frameset_base.html

Germany: There are three main research institutions involved in forecasting: the Institute for Labour Market and Vocational Research (IAB), the Federal Institute of Employment, and the Federal Institute for Vocational Training (BiBB). IAB's comprehensive employment forecast is based on an open econometric model that includes a modified trend extrapolation of some aspects of employment structure supported by qualitative expert ratings and quantitative scenario techniques. For more information, see http://iab.de/iab/default.htm

Australia: Employment projections have been carried out by the Centre of Policy Studies at Monash University (CoPS) for many years using the Monash general equilibrium model approach. See http://www.monash.edu.au, or for technical details of the model see http://monash.edu/policy/techdoc.htm

Canada: Employment projections are carried out by Human Resources Development Canada (HRDC) using the Canadian Occupational Projection Systems (COPS). For more info, see http://www.hrdc-drhc.gc.ca

Japan: Various organisations make labour market projections, but the most representative is that produced by the Ministry of Labour (MoL). The projections are based around forecast from a multi-sectoral macro model, including both supply and demand blocks. More detailed forecasts are done by the Japan Institute of Labour (JIL). For more info see http://www.jil.go.jp

USA: The organisation responsible for labour market projections in the USA is the Bureau of Labour Statistics (BLS) which has been examining future job prospects for over 50 years. Projections are based on macro-economic growth, population census and labour force surveys, and occupational employment surveys. Efforts have been made to measure generic skills in recent years, including the development of the O*NET system. For more info, see http://stats.bls.gov/ or http://www.onetcenter.org.data or http://www.laworkforce.net/ofc/index.htm

Ukraine: At the request of the Ministry of Economic Development and Trade and with the involvement of the Ukrainian Centre for Social Reforms (UCSR), the ETF supported the development of a 'Pilot Quantitative Skills Forecast' in Ukraine. The forecast methodology followed the standard steps of the multi-sectoral, modular-based quantitative model, which is similar to Cedefop's trans-European skills forecasting. Its main pillars contained macro-module, expansion demand module, replacement demand module, supply module, and imbalance module.

REFERENCE READING:

ETF-Cedefop-ILO (2016): Developing Skills Foresights, Scenarios and Forecasts, Volume 2, Guide to Anticipation and Matching Skills and Jobs, Luxembourg, available at: http://www.etf.europa.eu/web.nsf/pages/Vol._2_Developing_skills_foresights

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