

*Project “Applying the G20 Training Strategy:  
Partnership of the ILO and the Russian Federation” (2nd Phase)*

**ANALYSIS OF MARKET DEMAND FOR SKILLED WORKFORCE AND ITS APPLICATION  
TO VET DELIVERY PLANNING**

**(Stock-taking technical report)**

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Responsibility for the content and views expressed in the Report are those of the author and do not necessarily reflect the official opinion of the ILO

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## ABBREVIATIONS

CEDEFOP	-	European Centre for the Development of Vocational Training
EU	-	European Union
ETF	-	European Training Foundation
G20	-	An international forum for the governments and central bank governors from 20 most industrially developed nations founded in 1999
HE	-	Higher Education
HRD	-	Human resources development
ILO	-	International Labour Organization
ISCED	-	International Standard Classification of Education
ISCO	-	International Standard Classification of Occupations (ILO, 2008)
LFS	-	Labour force survey
OECD	-	The Organisation for Economic Co-operation and Development
PES	-	Public employment service
SDG	-	Sustainable Development Goals (UN)
UNESCO	-	United Nations Educational, Scientific and Cultural Organization
VET	-	Vocational education and training
WAP	-	Working age population

## REFERENCES

### INTRODUCTION<sup>1</sup>

Vocational education and training (VET) systems are always under the pressure from various bodies including industries which accuse them of not delivering skilled graduates to the labour market demand. VET systems continue seeking directions from the labour market analysis and forecasting regarding the shape and size of their training offer. This Report has reviewed international experience of the analysis and forecasting of market demand for skilled workforce and its implications for VET systems' operations. Improving "relevance" of skills development to the market demand for skilled labour has been a permanent policy featuring in all the international HRD conventions and recommendations<sup>2</sup> as well as in national skills development policies and strategic plans.

It is undeniable that better understanding of labour market needs and improving allocation of skilled workforce to jobs is important for reducing underemployment and achieving greater economic efficiency and job satisfaction.<sup>3</sup> Improvement of relevance of VET is a contributor to the broader task of matching of supply and demand in the labour markets. Improved matching of supply and demand in labour markets has become part of many strategic documents. The EU Skills Panorama launched in 2012 provides access to the data on current and forecasted employment by occupation in the

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<sup>1</sup> This Report is produced in line with the Output 1.2 of the Project "Applying the G20 Training Strategy: Partnership of the ILO and the Russian Federation" (2nd Phase).

<sup>2</sup> See for instance, ILO Convention 142 on Human Resources Development (1975); ILO Recommendation on human resources development: Education, training and lifelong learning (No. 195), 2004; Conclusions on skills for improved productivity, employment growth and development, ILC, ILO (2008); UNESCO Recommendation concerning technical and vocational education and training (TVET) (2015)

<sup>3</sup> Skill needs anticipation: Systems and approaches. Analysis of stakeholder survey on skill needs assessment and anticipation. ILO. Geneva, 2017.

national labour markets.<sup>4</sup> The OECD Employment Outlook is published annually to provide assessment of developments in national labour markets in the most developed economies. It monitors national labour market performance by using key indicators of job quantity, quality and inclusiveness.<sup>5</sup> The G20 Training Strategy has recognized the need for analysis of the current demand for labour and anticipation of future skills needs as one of its building blocks.<sup>6</sup> In spite of a very broad research and practice of analysis and forecasts of labour force in industrialized countries, the problems persist. For instance, in EU member states, “skills gaps and mismatches are striking. Many people work in jobs that do not match their talents. At the same time, 40% of European employers have difficulty finding people with the skills they need. Education and training providers on the one hand and employers and learners on the other have different perceptions of how well graduates prepared are for the labour market”<sup>7</sup>. The ILO in cooperation with Cedefop, and ETF published several Guides on anticipation of the future demand and supply of labour force. The Guides reviewed the international experience and advise on the utilization of labour market information in anticipating and matching skills and jobs.

However, it needs to be recognized that existing definitions of “demand for skills” lack clarity and VET systems face difficulties with interpreting them for operational purposes. There is no agreed understanding of the proxies to be used for describing the “demand for skilled labour” against which the VET systems can assess the degree of their relevance. Nor there is a shared understanding of how the results of analysis and forecasting of the demand for skilled labour can be applied to VET delivery. The domain of labour market research is very broad and involves hundreds of organizations and thousands of professional staff at least in industrialized countries. However, as it will be shown in this Report, little evidence has been found that the results of labour market analysis and forecasting are successfully applied to the allocation of training capacity, and planning of VET enrolments and graduates. One of the reasons is that forecasting focuses on the long-term anticipated demand and supply of skilled workforce which are less applicable to the *current* delivery objectives towards which VET systems navigate (see **Section VI. Conclusions**).

The literature on the approaches to analysis of the *current demand for skilled labour* is scarce, while it is exactly the analysis of the *current demand* which allows making interventions aiming to reducing the risks of skills mismatch through reshaping VET delivery. Some examples of interventions based on the labour market analysis involve for instance, the one in Japan (and elsewhere), where training courses were offered to those who plan to change jobs or upgrade skills; retraining of the unemployed on the basis of advice of Public Employment Service (PES) in Belgium towards occupations identified as in shortage. Similarly, the market analysis in Austria was used for advising on reshaping on-the-job training and retraining programmes to improve match to short- to medium-term skills needs, etc.<sup>8</sup> These training interventions however aim to adjust the capabilities of existing stock of workforce to the changed jobs. But few interventions are described on adjusting VET delivery and enrolments in initial VET to the identified demand for labour.

Further, the labour supply (and demand) forecasting are purely economic exercises which do not take account of the international HRD policies and recommendations such as the “education and

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<sup>4</sup> <http://skillspanorama.cedefop.europa.eu/en>

<sup>5</sup> For the OECD Employment Outlook 2017 see: <http://www.oecd.org/els/oecd-employment-outlook-19991266.htm>

<sup>6</sup> A skilled workforce for strong, sustainable and balanced growth. A G20 training strategy. ILO (2010)

<sup>7</sup> Communication from the Commission to the European Parliament, the Council, the Economic and Social Committee and the Committee of the Regions. A new skills agenda for Europe. Working together to strengthen human capital, employability and competitiveness. EU. 2016. 195 final

<sup>8</sup> Getting Skills Right: Skills for Jobs Indicators, OECD. Paris. 2017

training is a right for all”<sup>9</sup>; the current international and national policy objectives involving the continuing increase of qualifications levels of graduates, expanding the share of STEM<sup>10</sup> graduates in VET output,<sup>11</sup> etc. These policy objectives will continue increasing the imbalances between the demand and supply for skilled workforce. It is because in many countries, the current market demand for higher qualifications is behind the supply of them resulting in considerable numbers of skilled and educated unemployed or in occupational and qualificational mismatches.<sup>12</sup>

The labour force survey literature applies the terms “skills assessment” and “demand for skills” which are vague and allow for interpretations. In VET, for instance, the term “skills assessment” is equivalent to the “qualifications assessment” and should not be applied in the literature intended for VET professionals. In any case, in this Report, the analysis of demand for skilled labour does not refer to the content of occupational standards or qualifications or assessment thereof as this is a completely different area which has very little to do with balancing supply and demand for skilled labour. The labour force is considered as “skilled” on the basis of their formal vocational or educational attainment (Certificates, Diplomas or any other formal awards) or by years of practical experience in the skilled occupation or through self-assessment of capability for carrying out skilled tasks. Finally, many VET systems are unaware of or unable to utilise the results of labour market analysis and forecasts and continue navigating towards objectives which exclude parameters of the labour force.

This Report aims to inform VET professionals who seek information on how the “demand for skilled labour” is defined, and whether the results of the analysis and forecast of demand for labour can be utilised for improving relevance of VET delivery to the identified market demand.

## I. OBJECTIVES OF ANALYSIS OF LABOUR MARKETS

### I.1 Definitions of demand and supply

The market *demand for labour* is defined indirectly as a size and structure of employment by sector/industry/occupation. Shortage of skilled labour within these structures is a challenge which needs to be addressed.<sup>13</sup> Some other source defines the demand for trained and educated workforce “as occupational and qualification structures of economic sectors (organised and, if possible, unorganised economies) at the national and regional levels.”<sup>14</sup> The *supply side* is defined as an available population in working age or labour force by qualification or education field. Labour supply involves existing stocks of labour force and its flows looking to the numbers of new skilled labour entrants coming from vocational education and training (VET) institutions or migrants, etc.<sup>15</sup>

*Shortage/ or excess* of the skilled workforce occurs when the number of workers required in particular skilled jobs is *insufficient/or exceeds* the number of persons willing and capable of doing these jobs. The shortage of skilled workforce is commonly reflected by the increase of vacancies and,

<sup>9</sup> Human Resources Development Recommendation, ILO. 2004 (No. 195)

<sup>10</sup> Science, technology, engineering and math (STEM)

<sup>11</sup> V.Gasskov. Alignment of strategic objectives and performance indicators for skills development to the international HRD policy recommendations and experience. Stock-taking technical report. ILO, 2018

<sup>12</sup> See, for instance, the case of Korea: OECD skills strategy diagnostic report: Korea. OECD. 2015

<sup>13</sup> Guide to anticipating and matching skills and jobs. Working at sectoral level. Volume 3. ETF.CEDEFOP.ILO. 2016

<sup>14</sup> Review the sources and availability of skills development data. ICRA Management Consulting Services Limited. ILO. 2011

<sup>15</sup> Giesecke J., C. Shah and N. Tran. Review of methodological approaches to labour market forecasting and the measurement of current and emerging skill shortages. Final Report to the Department of Immigration and Citizenship. Centre of Policy Studies. Monash University. Australia. 2013

most notably, of hard-to-fill vacancies which may be reported by employers. The excess of skilled workers is reflected in skilled unemployment and under-employment. The mismatch may also involve under- and over- qualified workforce against the requirements of their jobs. The over-qualified comprise people working in jobs below their educational/training attainment level. In contrast, the under-qualified are those working in jobs above their educational/training attainment level what could result in productivity loss.<sup>16</sup>

It may be concluded from the above, that even if the current or forecasted employment structures of the labour force (defined as a “demand for labour”) become known, this information is difficult to interpret for operational guidance of VET. VET systems do not know what they have to do in order to maintain the current and forecasted employment structures. VET systems may also be assigned the task to reduce the identified skills shortage and mismatch between demand and supply of labour. However, the VET-based supply is only part of the national supply which is mostly represented by the stock of available labour. This means that VET systems have a problem with identification of labour market-based guidance for planning of training delivery.

## 1.2 Objectives of analysis of labour markets

Labour market forecasting literature is very broad. Labour market forecasting is said to be able to support decisions in the area of education and training which may require long lead time to produce graduates. It is assumed that skills anticipation produces early signals of probable future mismatches between the demand and supply for skilled workforce. It is reiterated in the literature that the purpose of forecasting is not to plan the training delivery from top down but rather to provide information to labour market participants so that to improve efficiency of markets.<sup>17</sup> However, employment and training markets fail in many cases because they do not take account of broad range of economic and social objectives and of the irrational behaviour of labour market participants. For this reason, many international agencies including the UN (UN SDG 2030<sup>18</sup>), the European Union<sup>19</sup> and OECD (see OECD Jobs Strategy<sup>20</sup>) do introduce strategic objectives and indicators which require the top down interventions in order to increase labour force participation, enhance equality of opportunity, quality of jobs, ensure that greater shares of youth acquire skills before entering the labour market, etc. The most recent move by the OECD was to review its Jobs Strategy aiming to address “*current* labour markets needs” since “in 2015, 40 million people were without work across the OECD; 40 million of young people of 15-29 years of age were in group NEET and, among them, 27 million were not actively looking for work.” The revised Job Strategy will be structured according to three objectives: 1) increased labour market participation, job creation and job quality; 2) a fairer distribution of opportunities and outcomes; and 3) more resilient and adaptable labour markets.<sup>21</sup> All these objectives assume the need for active management of labour markets.

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<sup>16</sup> Getting Skills Right: Skills for Jobs Indicators, OECD. Paris. 2017; Guide to anticipating and matching skills and jobs. Using labour market information. Volume 1. ETF.CEDEFOP.ILO. 2016.

<sup>17</sup> Guide to anticipating and matching skills and jobs. Developing skills foresights, scenarios and forecasts. Volume 2. ETF.CEDEFOP.ILO. 2016

<sup>18</sup> <https://unstats.un.org/sdgs/indicators/indicators-list/>

<sup>19</sup> Communication from the Commission to the European Parliament, the Council, the Economic and Social Committee and the Committee of the Regions. A new skills agenda for Europe. Working together to strengthen human capital, employability and competitiveness. EU. 2016. 195 final

<sup>20</sup> OECD Jobs strategy focuses on quantity and quality of jobs (<https://www.oecd.org/employment/jobs-strategy/>).

<sup>21</sup> Ministerial Statement: Building More Resilient and Inclusive Labour Markets. OECD Labour and Employment Ministerial Meeting. Paris, 15 January 2016 (<http://www.oecd.org/employment/ministerial/labour-ministerial-statement-2016.pdf>)

The major area of application of analysis of supply and demand of labour is suggested to be adjustment and reforms of education and employment policies,<sup>22</sup> review of education curricula, and related investment in the future probable demand for skilled workforce.<sup>23</sup> However, policies do not change frequently and a transformation of results of forecasts into policies may pose a challenge. As a result, the well-executed and informed forecast of the demand and supply of skilled labour may have little impact on policy making. The national forecasts of skilled labour provides a limited basis for making practical interventions in the provision of workforce. Some other studies should be carried out for identifying the types of mismatch taking places in industries and occupations, the hard-to-fill vacancies by occupation, the scale of graduate unemployment by area of study or occupation, etc. Such investigations may involve tracer studies of graduates, employer surveys on skills shortages, etc.<sup>24</sup> In the literature, education and training systems are viewed as one of the major instruments for reducing mismatch between the demand and supply of workforce mostly through ensuring informed access to continuing education enabling to adjust skills to changing labour markets. One of the quoted examples of new policies introduced in OECD countries on the basis of forecasts involves for instance, introduction of the lifelong skills development strategy in science, technology, engineering and mathematics (STEM) in Norway in 2006.<sup>25</sup> It is also apparent that such a decision could be made through the analysis of the current demand for skills on the basis of employers' survey and graduates' employment rates without any forecasting.

The findings of the recent survey conducted by the OECD on utilisation of analysis of labour markets indicated that up to 75% of labour ministries in the countries surveyed reported their use of "skills assessment and anticipation" for updating occupational standards, defining apprenticeship training programmes, designing or revising training programmes either for retraining or on-the-job training and for developing incentives for training provision. Up to 74% of ministries of education reported that they apply the results of analysis in updating qualifications frameworks, almost every country (74%-96%) designed new or revised training curricula, some 87% made selection of the priority upper-secondary vocational programs, etc.<sup>26</sup> The above data may raise doubts since it is impossible to make changes in occupational standards, qualifications and qualifications frameworks on the basis of labour market demand anticipation which aims to forecast the labour supply and demand for long-term periods. In industrialized countries, the review of relevance of occupational standards and related qualifications comes under the responsibility of sectoral organizations and/or national qualifications authorities and has to follow a nationally recognized process.

The aims of the forecasting may be summarised as the ones intended to identify the:

- Probable future structure of the labour force (in line with the definition of the "demand for labour") which will most likely prevail in the long-term time perspective (5-20 years). The labour market structures are commonly described as large occupational groups or, where possible, as sub-groups of ISCO-08. Some models underpinned by detailed research managed to forecast labour markets by occupation and qualification as well as by sector and region;

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<sup>22</sup> Guide to anticipating and matching skills and jobs. Using labour market information. Volume 1. ETF. CEDEFOP.ILO. 2016.

<sup>23</sup> Communication from the Commission to the European Parliament, the Council, the Economic and Social Committee and the Committee of the Regions. A new skills agenda for Europe. Working together to strengthen human capital, employability and competitiveness. EU. 2016. 195 final

<sup>24</sup> Skill needs anticipation: Systems and approaches. Analysis of stakeholder survey on skill needs assessment and anticipation. ILO. Geneva, 2017.

<sup>25</sup> Getting Skills Right: Assessing and Anticipating Changing Skill Needs, OECD Publishing, Paris. 2016.

<sup>26</sup> Skill needs anticipation: Systems and approaches. Analysis of stakeholder survey on skill needs assessment and anticipation. ILO. Geneva, 2017.

- Future supply of the skilled workforce by occupational group and qualification (available in stock and incoming);
- Future anticipated shortages or excess of skilled workforce by occupation and qualification arising from forecasted labour force demand and supply;
- Most likely mechanisms of reconciliation of the supply and demand and their probable flexibility affecting the time required for balancing the labour markets; It is exactly the area which allows to move from analytical findings to policy and operational recommendations for skills training systems.

### I.3 Approaches to forecasting of labour markets

#### *Quantitative modelling*

The forecast of future labour market demand, supply and the future probable mismatches is commonly implemented through a combination of macroeconomic modelling of future economic growth/decline, analysis of implications of technological changes by sector, extrapolation of the past occupational structures within sectors, and production of forecasts of labour needs by occupational group and, sometimes, by occupation and qualification. Modelling is based on assumptions, involves extrapolation of past trends (which may however, be less relevant in the future) and is a simplified representation of reality.<sup>27</sup> Modelling can produce projections of employment in sectors of the economy by occupational groups but these data are commonly insufficiently detailed for advising VET on planning of student enrolments by occupation and qualification. It is agreed that future labour markets cannot be predicted with certainty but forecasting allows to develop a view on how the future may look like. It helps applying certain logic of analysis of the future labour markets and developing scenarios for coping with future situations.

The future demand for skilled workers may increase/diminish for many reasons. Forecasting of the labour demand applies the recent past and current economic and labour market data as a base-line and develops assumptions on the future economic growth/decline by sector output and employment, demographic processes, occupational labour turnover, the need for replacement of labour, occupational migration flows, wages, etc. The increase of demand for skilled workforce in the labour markets may be signalled, for instance, by wage increases for specific categories of skilled workers and some other indicators which however require further investigation. The diminishing demand, by occupation, and reallocation of skilled workforce may be caused by, for instance, modernization of technology and resulting replacement of skilled manual operations with semi-automatic processing, etc. It is important to recognize that the labour demand forecasting is mostly unable to include assessment of future trends caused by technological changes which are the most difficult to anticipate.

Economic forecasting applies economic, demographic, and labour market data sources such as the national accounts, employment and labour force participation rates and wage information by occupation, employment by occupation and education, expansion demand and replacement demand, population trends. The supply side involves data on the available stock of skilled labour as well as on VET enrolments and graduations by occupation (see **Section II**).

#### *Behavioral analysis of labour market participants*

Quantitative modelling may also involve behavioural analysis which goes outside the economic forecasts and include explanation of reasons for labour market behaviour. Such models examine factors which influence the labour market behaviour of participants and how their behaviour influences the demand and supply of skilled workforce. Some studies also demonstrate that people

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<sup>27</sup> Wilson R.A. and Homenidou K. Futures 2010-2020: Technical report on sources and methods, UK Commission for Employment and Skills. 2012.

possessing certain occupational qualifications behave in the labour market differently from others in terms of their occupational turnover, etc.

### *Input-output models*

The so-called “input-output models” for market demand for workforce intend to identify the impact of changes in the demand for goods and services on production and employment in related economic sectors. Such models apply scenarios for the output development and its impact on production and employment inputs. The output may involve changes in the local demand for products, increase of direct investment or any other significant measures which may require changes in inputs (skilled labour). Input-output models use the existing employment structures in sectors concerned and the further changes in employment demand caused by the anticipated increase or decrease of output.<sup>28</sup> The OECD regularly publishes input-output tables for a number of countries. For instance, for the US, input-output tables are available for 420 sectors, and in the Netherlands - for 25 sectors. The input-output table shows how much each sector produces, how much of the production used by other production sectors with their labour force involved. The demand for production is translated into the demand for labour force on the basis of data for productivity. If occupational structures of related industries are known, the anticipated demand for labour by occupation caused by changes in the production output can be estimated.<sup>29</sup>

### *Labour market forecasting versus analysis of the current demand for labour*

Labour market mismatches keep taking place from year to year. Traditional methods of analysis of the current labour markets involve producing employers’ reports on skills shortages and hard-to-fill vacancies, collection of data by PES on the unemployment (by educational level, occupation, gender, etc.) and offering retraining courses for speeding-up inter occupational turnover. These measures however are only able to address the results of imperfections existing in the labour supply including the current allocation of VET services across regions, inadequate structure of VET programme offerings and inadequate planning of VET enrolments.

## **II. INDICATORS OF LABOUR MARKET ANALYSIS**

### II.1 Indicators of demand for labour force

The indicators proposed in the literature for measuring skills demand, skills supply and their mismatch in the labour force as well as the principle sources of data are listed in **Table 1**. The indicators of *demand for labour* involve:

- The aggregated *employment demand* (numbers and their change by economic activity showing growth or decline of the (sectoral) labour force caused by whatever factors). The change of sectoral/national employment results in the assessment of the *expansion-related demand* (or the expansion demand).
- Occupational and qualifications *structure of the workforce by large ISCO-08 occupational group* and sub-groups showing the numbers of jobs in the national economy requiring professionals (HE graduates), associate professionals (the technician Diploma holders), the skilled office workers (clerks), and the skilled manufacturing workers, etc. as well as the share of unskilled workers (ISCO Group 9).<sup>30</sup>

<sup>28</sup> Guide to anticipating and matching skills and jobs. Developing skills foresights, scenarios and forecasts. Volume 2. ETF.CEDEFOP.ILO. 2016

<sup>29</sup> [www.oecd.org/sti/inputoutput](http://www.oecd.org/sti/inputoutput)

<sup>30</sup> However, the “employment structure by ISCO occupational group” is not an equivalent of the “employment by occupation” and has little or no potential for being used for making policy or operational recommendations for skills training systems. In any ISCO group there can be hundreds of occupations in some of which there can

- The replacement demand by occupational group/occupation or qualification. The replacement of skilled labour is required to compensate for retirement, sickness, migration, persons becoming economically inactive or changing their occupations, etc. The age and gender structure of workers in each occupational group has an important affiliation with the probability of exit from the occupation.

## II.2 Indicators of labour supply

Indicators of the labour supply involve:

- The *size of the total stock* of national labour force and of the working age population aged 15-64 (WAP) and its age structure (in particular, a share of the age group 20-24 in the total workforce is a key indicator of the size of future labour supply).<sup>31</sup>
- The *educational attainment structure* (by the highest education level attained) of the workforce by ISCED levels and by gender.
- The *qualifications structure* of the working age population and of the labour force (assuming that skilled workers may, however, possess several occupational qualifications)
- *Structure of annual VET graduates* by occupational area and qualification.<sup>32</sup>
- *Participation of adults* in continuing education (share of workers upgrading their skills annually).<sup>33</sup>

It should be understood that the supply structure shown above is not uniform in that the experienced skilled workers cannot be directly replaced with fresh VET graduates.

## II.3 Indicators of mismatch

The indicators of mismatch represent the results of interaction between the demand and supply of the skilled workforce and involve:

- *Excess of labour by education and qualification*: The unemployment rate by education/qualification level (share of unemployed persons possessing a certain education level to the total number of persons in the labour force with this education/qualification level).<sup>34</sup>
- *Excess of labour by occupation*: The unemployment rate by occupation (share of unemployed persons in the occupation to the total number of skilled persons in this occupation in the national labour force).<sup>35</sup>

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be shortage and in some can be excess of skilled workforce. Most countries are however unable to produce detailed data on occupational structures of their labour forces or jobs.

<sup>31</sup> If the share of this age group is higher than that of older groups in the labour force, over supply of labour should be expected. The demographic information on age cohorts is available in most developing countries as well as the pass rates of school age youth enabling to calculate the share of youth graduating from secondary school who may enrol in higher level qualifications

<sup>32</sup> Not all the education and training graduates intend to work in the occupations in which they had been trained and may not immediately rush to take the available jobs. Some of them or many may join the group NEET (Not in Education, Employment or Training)

<sup>33</sup> Participation in skill training is part of the mechanism of adjustment of supply to demand what may reduce the number of job vacancies. However, the current average rate of participation in continuing training in the EU member states remains insignificant and stands at around 10%

<sup>34</sup> This indicator works if it is known that educated persons are employed in the jobs requiring their educational attainment. Many educated persons may be employed in unskilled jobs and the number of the educated unemployed may be much less

<sup>35</sup> This indicator works if: a) the number of skilled persons in the labour force in a certain occupation is known and b) the number of skilled unemployed persons in the occupation is known since many of them can take jobs in other occupations

- *Shortage of skilled workforce*: Vacancy rate by occupation and qualification (percentage of vacancies including hard to fill vacancies in an occupation/qualification relative the total number of jobs in this occupation/qualification).<sup>36</sup>
- The *dynamics of wage in occupation and qualification* may reflect excess or shortage of people in this occupation and with this qualification.<sup>37</sup>
- *Occupational mismatch* reflects the share of persons who are employed in occupations which do not correspond to their education and training attainment (or experience) by the area of study.

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<sup>36</sup> Vacancies and hard-to-fill vacancies are interpreted as skills shortages provided that they exist due to lack of qualified applicants but not due to low pay and unfavourable working conditions, etc. For instance, a vacancy rate can be calculated for the jobs requiring technician Diploma.

<sup>37</sup> Wages is one of the instruments of the labour market adjustment since employers can quickly increase wages to attract the skilled but economically inactive individuals to take jobs

**Table 1. Summary of labour market indicators and sources of data** <sup>38</sup>

Categories	LFS	PES	Enterprise data	Education and training data	Census	Establishment survey	Tracer studies
<b>Demand for skilled workforce (national or by economic activity)</b>							
1.The aggregated employment demand: Number of the employed and its change showing growth or decline of the labour force ( <i>expansion demand</i> ).	X						
2. Occupational and qualifications structure of the aggregated employment demand by ISCO-08 occupational group, sub-group, occupation and qualification	X				X		
3. The <i>replacement demand</i> of labour force (by occupation) (share of skilled labour force employed in an occupation which needs to to be replaced annually)	X				X		
<b>Supply of skilled workforce</b>							
1. The stock of working age population/ labour force by age	X						
2. Working age population /labour force by highest education level attained and gender							
3.Working age population by professional qualification attained	X						
4. Structure of annual VET graduates (by occupational area and qualification) from formal programs and apprenticeships				X			

<sup>38</sup> Based on format provided in the “Guide to anticipating and matching skills and jobs. Using labour market information”. Volume 1. ETF.CEDEFOP.ILO. 2016. (pp. 58-61).

Categories	LFS	PES	Enterprise data	Education and training data	Census	Establishment survey	Tracer studies
5. Participation of adults in education and training leading to the full or partial qualification	X						
<b>Mismatch indicators</b>							
1. Excess by education and qualification: The unemployment rate by level of education/qualification (share of unemployed persons possessing the educational level/qualification to the total number of persons in the labour force with this level)	X	X					
2. Excess by occupation: The unemployment rate by occupation (share of unemployed skilled persons in the occupation to the total number of persons employed in this occupation)		X					
3. Shortage of skilled workforce: Vacancy rate by occupation and qualification (percentage of vacancies and of hard to fill vacancies in an occupation to the total number of jobs in this occupation)						X	
4. Wage dynamics by occupation and qualification reflecting shortage or excess of labour			X				
5. Qualifications mismatch: Share of persons who are employed in relevant occupation but below or above the qualifications level required in his/her current job.	X					X	
6. Occupational mismatch: Share of persons who are employed in occupations							

Categories	LFS	PES	Enterprise data	Education and training data	Census	Establishment survey	Tracer studies
which do not correspond to their education and training attainment (or experience) by the area of study							
7. Beveridge curve (the number of vacancies by occupation versus the number of unemployed seeking jobs in this occupation)			X				
8. Unemployment rate of recent VET graduates by the acquired occupation and qualification						X	X
9. A share of recent VET graduates employed in the occupations other than those in which they had been trained						X	X
10. Employer satisfaction with the availability of skilled workforce by occupation and qualification						X	

- *Qualifications mismatch* is a share of persons who are employed in relevant occupations but below or above the level required in their current jobs. The former persons are underqualified, the latter are overqualified.<sup>39</sup>
- *The number of vacancies by occupation versus the number of unemployed* seeking jobs in this occupation (Beveridge curve). The high ratio may reflect the poor matching process or prevalence of poor conditions of employment for such an occupation.
- *Unemployment rate of recent VET graduates by the acquired occupation and qualification*. This is a measure of excess of graduates in an occupation/qualification as well as the measure of quality of professional education.
- *Share of recent VET graduates employed in the occupations other than those in which they had been trained*. It is also a measure of excess of graduates in an occupation/qualification as well as the measure of quality of professional education.
- *Employers' satisfaction* with the availability of skilled labour by occupation and qualification.

Not all of the above indicators are commonly available and in practice, it is the availability and reliability of the data that determines the choice of indicators to apply. Often the labour market demand by occupation and supply of skilled workers are analysed independently of each other while the demand and supply sides of the market interact and adjust to each other.

#### II.4 In-depth analysis of current and emerging shortages of skilled workforce

##### *Indicators for measuring current shortages of skilled workforce*

Shortage of skilled workforce is a feature of mismatch. It is identified when industry failed to fill in its vacancies from the stock of skilled workforce available in local labour markets as well as from fresh VET graduates. Some vacancies which are particularly difficult to fill-in are called "*hard-to-fill*". Shortages of labour (expressed as unfilled vacancies) are commonly reported by employers. As shown above, an occupational shortage of skilled workforce can be estimated as a share of unfilled vacancies relative the number of the employed in the same occupation (if caused by shortage of skilled job seekers).

##### *Labour shortages versus recruitment difficulties*

Unemployment of skilled persons in an occupation and hard-to-fill vacancies in the same occupation may co-exist because of the precarious conditions of employment and because of the labour turnover between jobs and occupations. If employers cannot fill certain vacancies in spite of the availability of skilled workers, the situation is defined as *recruitment difficulties*.<sup>40</sup> The reasons can include low remuneration, inadequate working conditions, etc. Skilled workers as well as fresh graduates may prefer to stay unemployed or find jobs where they can use their skills only partially. Given the complex range of conditions required for attracting and retaining skilled workers, very large numbers of them tend to be employed in either unskilled jobs or in other occupations. In persistent precarious conditions of employment, *the increased supply of fresh VET graduates may have no impact on reducing the number of vacancies*.

##### *Mechanisms of market adjustment to occupational shortages*

The employers experiencing shortages of skilled workforce may:

<sup>39</sup> Getting Skills Right: Skills for Jobs Indicators, OECD. Paris. 2017

<sup>40</sup> For example, out of the 560,000 vacancies in England from the Employers Skills Survey in 1999, 255,000 were hard-to-fill, but in fact only 110,000 of these were skills shortages, the rest were due to the recruitment difficulties. Skills for all: Research Report from the National Skills Task Force, SKT 29, Department for Education and Employment (UK), Nottingham. National Skills Task Force 2000.

- increase wages or improve recruitment conditions for workers with required occupations who previously had been economically inactive;
- recruit workers who are not completely skilled against their job requirements (and perhaps train them) while they may still continue reporting shortage of skilled workers;
- recruit workers who have higher qualifications than the ones required for the jobs;
- increase enrolment of apprentices;
- may reduce the production volume, etc.<sup>41</sup>

The time required for a labour market to adjust to shortages of skilled workforce depends on a number of factors, including the complexity of occupations in demand and the related period of time for training required, the availability of stock of skilled labour who have relevant occupations and may be attracted by increased entry wages, etc. Shortages and surpluses of skilled workers commonly fluctuate within long periods of time and over the period of, let say, one year, no essential disbalances of skilled workers can be identified.

The market adjustment to current shortages of skilled workforce through making changes to formal VET programs is unrealistic due to the long lead time required. However, if shortage in certain occupation persists in regional labour markets then the VET system can encourage enrolments in priority occupations. It is a common mistake when national VET systems are required to immediately respond to the identified skills shortages instead of planning student enrolments on the basis of the fundamental parameters of the regional labour markets.

#### *Occupational unemployment and occupational turnover*

A high rate of unemployed in an occupation relative the number of persons employed in an occupation indicates a surplus while a low rate indicates a shortage of skilled workers. It is however important to identify whether the unemployed (applicants seeking employment in an occupation) are indeed formally qualified for it. Some of them may have failed to find employment in an occupation for the reason of under qualification. It is also possible that some or many of skilled workers in the occupation in question occupy different skilled or unskilled jobs and for this reason they are not counted. Unemployment and vacancies per occupation may also co-exist because of labour turnover, and not necessarily because of shortage of skilled persons. The shortages of skilled workforce may be routinely filled in with workers coming from other occupations.

#### *Assessment of emerging skills shortages by movements of hourly pay averages*

In a market economy, wages are supposed to reflect the demand for skilled workers. A shortage of skilled electricians should push their remuneration up or the work will be done unprofessionally. It is not always, however, that a large increase in wages can generate a reasonable increase in availability of skilled workers as this will depend on the stock of such workers in the working age population. Hourly compensation per occupation are collected in some countries, for instance in the US<sup>42</sup>, over years and used, among other indicators, for anticipation of the changes in demand. The *absolute readings* of hourly remuneration data cannot accurately indicate the demand for labour because wages reflect many things including complexity of work, etc. However, positive changes in hourly compensation for individual occupations by year or, better, by quarter, is a very important indicator of demand for this occupation in a certain region.

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<sup>41</sup> Based on: Giesecke J., C. Shah and N. Tran. Review of methodological approaches to labour market forecasting and the measurement of current and emerging skill shortages. Final Report to the Department of Immigration and Citizenship. Centre of Policy Studies. Monash University. Australia. 2013.

<sup>42</sup> <http://www.bls.gov/bls/blswage.htm>

**Table 2** shows selected labour market indicators which are most frequently applied for assessment of skills shortages in an occupation. These can be combined in many ways depending on the availability of base-line and forecasted data.

**Table 2. Selected labour market indicators applied for identification of emerging or existing skills shortages in an occupation<sup>43</sup>**

Skills shortages tend to increase if the following is observed:
<b>1. Vacancies in the occupation</b>
High or persistent vacancies in the occupation reported by employers
High share of vacancies relative the total employment in the occupation
A low fill rate of vacancies due to shortage of skilled applicants in the market
<b>2. Unemployment/Employment level and employment conditions</b>
Rising overall employment of skilled persons in the occupation
Low or declining unemployment of persons seeking jobs in the occupation
Rising hours worked
Proportion of older workforce aged 45 or 55 years and over in the occupation (%) <sup>44</sup>
<b>3. Wage movements</b>
High and rising wages
<b>4. Training by qualification</b>
Rising number of VET enrolments and graduates in the occupation
Rising number of concluded apprenticeship contracts in the occupation
<b>5. VET graduates' employment and outcome</b>
High and/or rising employment in the occupation
High and/or rising mean hours worked by graduates per week
High and/or rising mean full-time annual salary (\$'000s) paid to VET graduates

### III. METHODOLOGY OF LABOUR MARKET FORECASTING

#### III.1 Employment demand and the expansion demand

The labour market forecasting aims to anticipate the “demand” expressed as future employment structures of the workforce nationally, by sector, and in regions. The ultimate purpose of such forecasts is identification of probable shortages of skilled labour in the future. Forecasts aim to model both, the demand and the supply side of the labour market and commonly are carried out independently, and not integrated. The following major categories are applied in forecasts of the demand for labour force: a) employment demand, b) expansion-related demand (or expansion demand), and c) replacement demand. Data are collected for these variables for producing estimates of the future demand.

In some countries- USA, UK, the EU and Japan, employment demand by industry is estimated econometrically as a function of industry output, real producer wages, average hours worked, etc. The approach to projecting industry employment used in South Korea, New Zealand, and Finland estimates industry's future employment on the basis of changes in industry output and labour productivity. Outputs from the macroeconomic model are used as an input to the labour market

<sup>43</sup> Based on: Giesecke J., C. Shah and N. Tran. Review of methodological approaches to labour market forecasting and the measurement of current and emerging skill shortages. Final Report to the Department of Immigration and Citizenship. Centre of Policy Studies. Monash University. Australia. 2013 (see Table 1).

<sup>44</sup> Low proportion of older workers means higher turnover and low stability of occupational employment

forecasting. Forecast of output and employment by industry sector is preceded by the macro forecast of the national economy.<sup>45</sup>

Demand for skilled workforce in sectors is affected by *growth or decline* of the sectoral economic outputs (sector GDP), anticipated technological change, and productivity improvement which may require more workers or fewer workers or different workers to be hired. It is not uncommon however that the growth of the economy is not accompanied by the matching employment growth because of the offsetting effect of the productivity growth.

In projecting future employment, the occupational shares in the labour force are assumed to change. These changes are based on extrapolations of past trends, and may also be modified further to reflect anticipated shifts in industry production and technologies. Adjustment of future occupational shares is informed by extrapolation of past changes, and expert judgement.<sup>46</sup> Technological change commonly impacts on the occupational structure and skill profiles of the workforce unevenly by reducing the demand for skilled workers in certain occupations and increasing the demand for workers in some other as well as in new occupations. Therefore, the assessment of the “expansion-related demand” by occupation and qualification is to be linked to the anticipated changes in output. The implications of technological change for the demand for skilled workforce are very difficult to assess when it is not known what technologies will be introduced. In the large-scale technology transfer projects when new technologies are replacing the old processes and machines, the changes in demand for skilled labour are much more certain and can be calculated. In the short-term forecast, assessment of the expansion-related demand can also be based on the assumption that the past growth/decline rate of economic sector’s employment, its occupational structure and productivity will remain the same.

The “expansion demand” constitutes net new job openings arising from change in industry demand for labour by occupation. Job openings by occupation also arise from retirement, mortality, emigration, and inter-occupational mobility and constitute the labour force “replacement demand”.

Data sources for the forecasting of labour markets commonly include population censuses, national accounts, input-output tables, labour force surveys, employment statistics, and education statistics.<sup>47</sup> Quantitative model-based projections are thought to have advantages over other methods of anticipation as such projections are comprehensive and consistent. They cover the whole economy and, at the same time, can provide a high level of disaggregation by industry and occupational group.

### III.2 Replacement demand

#### *Definitive exits*

The “replacement demand” for skilled workforce emerges as a need to *replace* employees leaving industry because of their exit from an occupation, continuation of a study full-time, death, sickness,

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<sup>45</sup> CEDEFOP. Future skills supply and demand in Europe. Research paper No. 26, Publication Office of the European Union, Luxembourg. 2012. [http://www.Cedefop.europa.eu/EN/Files/5526\\_en.pdf](http://www.Cedefop.europa.eu/EN/Files/5526_en.pdf).

<sup>46</sup> Employment projections. In Handbook of Methods, U.S. Bureau of Labor Statistics, Chapter 13, Available at <https://www.bls.gov/opub/hom/emp/pdf/emp.pdf>

<sup>47</sup> See, for example, a review of forecasting models in OECD countries in Giesecke J., C. Shah and N. Tran. Review of methodological approaches to labour market forecasting and the measurement of current and emerging skill shortages. Final Report to the Department of Immigration and Citizenship. Centre of Policy Studies. Monash University. Australia. 2013. Other examples of labour market forecasting systems are described in BLS Handbook of Methods (last revision in 2008), Wilson and Homenidou Wilson R.A. and Homenidou K. Futures 2010-2020: Technical report on sources and methods, UKCES. 2012

maternity leave, migration, or quitting the labour market, for various reasons. The size of the replacement demand is commonly much greater than the expansion-related demand. The “net replacement demand” refers to job openings that are made available from workers leaving an occupation after accounting for those re-entering the occupation (or those skilled workers who can be employed from the labour market).<sup>48</sup> The demand for labour replacement due to the *retirement* is sometimes assessed through the method of age group shifts in the workforce per occupation when shares reaching the retirement age are calculated as part of the replacement demand. The approach of age group shifts is useful only when there the strict national retirement regulations are enforced and strong disincentives for not working after the retirement ages exist. Statistical data may also apply for calculating the death and accident rates which are also used in forecasting of the replacement demand.

#### *Labour turnover*

Turnover is another powerful cause of replacement demand. There are two types of the skilled worker turnover. The first is when skilled workers move to become employed in some other industry/company *without changing their occupations*. In this case, the total demand for skilled workforce in the region/nation will not be affected, while such a turnover may impact on the demand for skilled workers in a specific industry sector. The second is when skilled workers intend to *change their occupations*. Such a turnover may result in the skills shortage in the economy. The data on the flow of skilled workers quitting their companies and going to change their occupations can only be gleaned through *establishment surveys* involving interviews with exiting and returning workers. A probability of a worker leaving the occupation was found to be strongly dependent on: the type of the occupation, age of the worker, and tenure<sup>49</sup>. The size of occupational turnover and the resulting replacement demand can be very significant.<sup>50</sup>

Labour force turnover by occupation can also be analysed through the labour force survey (LFS) which surveys households. The survey needs to ask respondents the questions regarding the change of an employer and/or an occupation in the 12 months preceding the survey. Reasons for changing the employer/ occupation need to be enquired as well as the type of benefits which a worker expects to become entitled to after the change. More details can be revealed regarding the directions of occupational shift: from which occupation to which occupation workers change and why. The above studies of the labour turnover requiring interviews with individual workers in companies exiting industry sector by each skilled occupation/qualification are however expensive. A less costly *approach* which involves collecting data on the replacement demand without, however, knowing the reasons of such turnover involves establishment surveys of a sample of companies in a sector.

Analysis of the demand in a single economic sector should mostly be concerned with the sector-specific occupations and qualifications which are not employed by other sectors. If the demand is to be assessed for mass occupations such as for instance, electricians, then such estimates cannot be used reliably for making the training supply decisions for a particular sector because the relevant VET graduates can be employed in other sectors.

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<sup>48</sup> Demand and supply of accountants. Australian Workforce and Productivity Agency. March 2014.

<sup>49</sup> Karmel, T., P. Lim, and J. Misko. Attrition in the trades. NCVET. Australia. Monograph series 07/2011

<sup>50</sup> For instance, every year approximately 14% of Quebec’s construction workers discontinue working as construction industry employees because of retirement, change of industry, starting a new business, etc., and only 7% of them eventually return to industry to continue working. It results in the annual net requirement for this industry to fill 7% of jobs left vacant. Overall, due to the increase in demand for services (expansion demand) and labour turnover and aging (replacement demand), the construction industry needs approximately 9,000 new workers each year. Source: Construction looking forward. Labour requirements from 2007 to 2010 for Quebec. Construction Sector Council. Quebec. Canada. 2010.

### *Projections of replacement demand*

The replacement demand makes the major input in job openings. For example, in the USA, forecasts for 2010-2020 show that 33.7 million job openings are expected to come from replacement of labour, whereas only 21.1 million will come from expansion demand. Job openings due to replacement needs exceed the openings due to growth in 80 per cent of occupations<sup>51</sup>. The ratio of replacement demand to expansion demand is around 9:1 for the EU as a whole. According to the forecasts, up to 2020, the European economy will create some eight million new jobs. However, nearly ten times as many jobs, around 75 million, will need to be filled as people retire or leave the workforce. Weak employment growth in Europe indicates that there may be a considerable oversupply of people with high-level qualifications.<sup>52</sup> One of the approaches for estimating replacement rates by occupation applies 5-year age groups based on historical data. These replacement rates are then applied to estimate future labour force replacement needs.<sup>53</sup>

### *Forecasting new job openings by occupation and qualification*

Forecasting aims to estimate job openings by occupation. The number of new job openings by occupation involves openings due to expansion demand and openings due to replacement needs. It is possible to project demand by qualification as well provided that shares by qualification in each occupation are known from historical data and can be extrapolated. For instance, in Australia, the latest employment projection was conducted for the period 2012-2018 for 214 industries, 353 occupations, 5 qualifications levels, and 61 labour force regions. The projections were based on data from the LFS.<sup>54</sup> In any case, occupational projections are to be preceded by the sectoral employment projections.

## III.3 Labour supply projections

### *Forecasting future stock of workforce*

Labour supply forecasting begins with projections of the population, including immigration. The number of working age population (WAP) and the labour force participation rate need to be estimated. The simplest is to extrapolate labour participation rate from historic data or it can be estimated as a function of other variables. For instance, the US Bureau of Labour Statistics (BLS) forecasts labour supply for 136 categories, which are defined as age, gender, race and ethnic groups.<sup>55</sup>

Forecasting the occupation and qualification-specific labour supply should involve estimates of the future labour stock by occupation and its flow.<sup>56</sup> Most countries forecast changes in the stock of the population and the labour force by highest educational attainment level based on estimates of trends in educational level acquisition patterns by age and gender. In the UK, the forecast is based

<sup>51</sup> Lockard, C.B. and M. Wolf. Occupational employment projections to 2020. Monthly Labor Review, January 2012, 84-108.

<sup>52</sup> It is argued that by 2020, Europe will have the most highly-qualified workforce in its history. CEDEFOP. Future skills supply and demand in Europe, Research paper No. 26, Publication Office of the European Union, Luxembourg. 2012. <http://www.Cedefop.europa.eu>

<sup>53</sup> BLS. Employment projections. In Handbook of Methods, U.S. Bureau of Labor Statistics, 2013. Chapter 13. <https://www.bls.gov/opub/hom/emp/pdf/emp.pdf>

<sup>54</sup> Australian Department of Education, Employment and Workplace Relations (DEEWR). <http://lmip.gov.au/default.aspx?LMIP>.

<sup>55</sup> Employment projections. In Handbook of methods, U.S. Bureau of Labor Statistics, 2013. Chapter 13. <https://www.bls.gov/opub/hom/emp/pdf/emp.pdf>

<sup>56</sup> CEDEFOP. Future skills supply and demand in Europe: Methodological framework. Research paper No. 25, 2012. Luxembourg. [http://www.Cedefop.europa.eu/EN/Files/5525\\_en.pdf](http://www.Cedefop.europa.eu/EN/Files/5525_en.pdf)

on labour force survey data and population forecasts. The base-line data of the initial stock of the labour force by qualification is estimated from the labour force survey. Inflows into each occupational qualification are added and include new graduates, modified by trends in educational qualification acquisition rates and labour force participation rates.<sup>57</sup>

To be useful for guiding VET planning, forecasts should produce estimates of the future stock of labour by occupation and qualification and immigration flows with related details. However, about a third of the national forecasting systems do not disaggregate labour supply by occupation and qualification due to enormous technical difficulties in producing such data.<sup>58</sup> When the demand and supply are not estimated by occupation and qualification, it is impossible to forecast probable shortages of skilled labour in detail. Nor it is possible to apply such forecasts as guidance for VET delivery.

#### *Forecasting new entrants by occupation*

Having identified the stock of persons by occupation it is necessary to assess annual inflows to occupations. The gender-specific shares of the stock of skilled labour and of the new entrants are commonly estimated. The flows into the number of job seekers by occupation include: new VET graduates, labour market re-entrants, immigrants, and entrants from other occupations via occupational turnover. The turnover-based occupational supply is the most difficult to estimate and to date the concept of inflows has been used primarily for policy analysis, not forecasting.<sup>59</sup>

The sequential steps in projecting future demand and supply by occupation and qualification are shown in **Table 3**. In principle, future mismatch by occupation and qualification may be estimated by comparing demand and supply.

**Table 3. Major steps of forecasting of labour demand and supply by occupation<sup>60</sup>**

<b>Future labour demand</b>	<b>Future labour supply</b>	<b>Details of estimation of labour supply</b>
D1. Projections of the macro economy, which incorporate projections for the total employed labour force (aggregate labour demand)	S1. Projections of national aggregate labour supply	S1.1 Base year stock of population S1.2 Population projections by age, gender, educational attainment, etc. S1.3 Projection of labour force participation rate S1.4 Unemployment rate projection S1.5 Projection of skilled migration
D2. Projections of <i>output</i> and <i>occupational structures</i> by industry sector (labour demand by sector)	S2. Projections of the sectoral workforce by	S2.1 Base year stock of people in labour force by occupation/qualification S2.2 Sector-based projections of labour force by occupation

<sup>57</sup> Wilson R.A. and Homenidou K. Futures 2010-2020: Technical report on sources and methods, UK Commission for Employment and Skills. 2012. <http://www.ukces.org.uk/assets/ukces/docs/publications/working-futures-technical-report.pdf>.

<sup>58</sup> Giesecke J., C. Shah and N. Tran. Review of methodological approaches to labour market forecasting and the measurement of current and emerging skill shortages. Final Report to the Department of Immigration and Citizenship. Centre of Policy Studies. Monash University. Australia. 2013.; Wilson, R., M. May-Gillings and R. Beaven. Working Futures 2012-2022: Technical report on sources and methods. UKCES. 2014

<sup>59</sup> Measuring the economic impact of further education. Department for Business, Innovation & Skills. UK. BIS Research Paper N.38. 2011

<sup>60</sup> Interpreted by the author on the basis of: Giesecke J., C. Shah and N. Tran. Review of methodological approaches to labour market forecasting and the measurement of current and emerging skill shortages. Final Report to the Department of Immigration and Citizenship. Centre of Policy Studies. Monash University. Australia. 2013 (see. Fig.3)

	occupation and qualification	S2.3 Annual numbers of VET graduates produced by occupation/qualification in base year and their forecast S2.4 Resulting stock of people in the labour force by occupation/ qualification (without other entrants) (sum of the forecast stock of labour force and of annual VET graduates taking account of labour force participation rate)
D3. Projections of sector-based <i>expansion demand</i> for labour force by occupation and qualification	S3.1 Projections of <i>other entrants</i> by occupation and qualification	S3.1.1 Assessment of the current and future inflows of labour force into occupation through <i>labour turnover</i> S3.1.2 Assessment of current and future inflows of <i>migrants</i> by occupation
D4. Projections of <i>replacement demand</i> by occupation and qualification	S3.2 Projections of the total number of job seekers by occupation and qualification	S3.2.1 Resulting stock of the forecast national supply by occupation: a) stock of labour force by occupation (employed and unemployed) b) fresh VET graduates (who may be unable to directly replace skilled workers) c) skilled migrants, and d) other persons who may acquire qualifications during the forecasting period)
D5. Projection of <i>total number of job openings</i> (expansion demand and replacement demand) by occupation and qualification		
D6. Projections of the total number of <i>net vacancies</i> (after filling some job openings by qualified job seekers) by occupation and qualification		
D.7 Assessment of future <i>shortages of skilled workforce</i> by occupation and qualification and the supply-demand reconciliation		

#### III.4 Anticipation of future skills shortages

After projecting labour demand and labour supply by occupation there is a possibility to compare or identify a mechanism for reconciling the supply and demand. Comparison of independent demand- and supply-side estimates of labour force can inform discussion of probable shortages of skilled labour force (by occupation) and provide inputs to migration policies. Forecast of the demand by occupation is useful for guiding labour market participants and future entrants in making education and career choices. However, the anticipated future shortages may have little impact on long-term planning of enrolments in skilled worker programs because these are relatively short-term. As far as the HE qualifications are concerned requiring long lead time to complete studies, the strategic planning of enrolments and graduates may take account of the forecast shortages.

Measures of anticipated shortages are provided by: a) estimates of prospects for labour market entrants and b) skills mismatch indicators. Prospects for labour market entrants are assessed by: projections for skilled occupations, statements of good or poor job prospects by occupation/

qualification measured as a ratio of estimated annual supply to the stock of employment in each occupation/qualification, the current and forecasted unemployment rate by qualification.

Most countries calculate *labour market mismatch* as the difference between, or the ratio of, supply and demand by occupation and/or qualification. The mismatch indicators involve: anticipated excess by occupation and qualification, actual mismatch based on past trends and potential mismatch based on future demand and supply changes by occupation, etc. (see **Table 2**). However, in Canada, the future labour market imbalances (shortages) are defined as a difference between the anticipated job openings and the number of job seekers available to fill them over the forecast period. In the Netherlands, the indicator for assessment of the labour market prospects for different occupations/qualifications is calculated as the ratio of anticipated supply to anticipated demand in the forecast year.<sup>61</sup>

When labour demand and labour supply are estimated independently and then compared, they do not take into account the continuing interactions between demand and supply which in the long run will reconcile them. There are several adjustment mechanisms that operate in the labour market to reconcile imbalances that may arise. In the short term, these include adjustments in wages, employer provided training, as well as changes in the ways employers use the skilled workforce, etc.

The reconciliation of supply and demand by occupation can be presented as the following major models:

- The first model is based on the assumption that the training system is flexible, adjusting enrolments and graduates to the anticipated demand enabling to maintain relative wage rates. In this case, changes in enrolments serve as an indicator of labour market demand pressures.
- The second model assumes that the training system is inflexible, with enrolments and graduations determined without any link to the forecasted demand. Under this assumption, qualification-specific wage rates will need to adjust to reconcile both labour demand and labour supply. In this case, the extent of wage adjustment serves as the indicator of labour market pressure.<sup>62</sup>
- In the third model, the demand and supply may also be reconciled through reallocating people to jobs until all those available are employed. If future supply of skilled labour shows excess over the demand, this would result in raising the qualifications intensity of jobs, no matter if jobs do require skilled persons in such numbers. This scenario indeed takes place when the number of high skilled jobs created is lagging behind the number of high-skilled persons produced annually.<sup>63</sup>

The proposed reconciliation models can work only in flexible labour markets with well organized labour market information, incentives rewarding higher qualifications, and with well-informed behaviour of labour market participants.

For the purpose of this Report, the capability of formal VET and of on-job training systems to contribute to the supply of skilled labour in line with forecast demand is viewed as the major

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<sup>61</sup> Based on: Giesecke J., C. Shah and N. Tran. Review of methodological approaches to labour market forecasting and the measurement of current and emerging skill shortages. Final Report to the Department of Immigration and Citizenship. Centre of Policy Studies. Monash University. Australia. 2013

<sup>62</sup> Giesecke, J.A., N.H. Tran, G.A. Meagher and F. Pang. Growth and change in the Vietnamese labour market: A decomposition of forecast trends in employment 2010-2020, General Working Paper No. G-216, Centre of Policy Studies, Monash University, March 2011.

<sup>63</sup> CEDEFOP. Future skills supply and demand in Europe, Research paper No. 26, Publication Office of the European Union, Luxembourg. 2012. <http://www.Cedefop.europa.eu>

adjustment mechanism. However, the flexible VET systems can do little if training and employment preferences of students deviate from the identified demand or the labour market does not offer relevant incentives or information.

#### **IV. APPLICATION OF LABOUR MARKET ANALYSIS AND FORECASTING**

##### IV.1 Pan-European forecasts<sup>64</sup>

###### *The context of forecasting in EU*

The need for analysis and anticipation of the demand for skilled workforce was recognized in the 'New Skills for New Jobs' initiative which had been launched by the EU in 2008.<sup>65</sup> The New Skills for New Jobs initiative aimed to promote better anticipation of future skills needs and improve matching between skilled labour and the market needs. This initiative included forecasts by the European Centre for the Development of Vocational Training (Cedefop), analysis of emerging trends at sectoral level, etc. CEDEFOP carried out the pan-European and national forecasts as well as the forecasts by sector of the economy. Under the 2020 strategy (Agenda for New Skills and Jobs) the European Commission developed the EU Skills Panorama to improve labour market information for jobseekers, workers, companies, etc.<sup>66</sup> Cedefop's skill supply and demand forecasts is one of key building blocks of the EU Skills Panorama. The data in Skills Panorama involve the employment growth forecasts by 2025 by country, sector, occupational group, employment shares by sector in occupational groups, skills shortages overall and at hiring. It also lists major occupations which are in shortage. This site does offer any information on the anticipated supply and the role VET and HE systems in supply graduates by year of the forecasts.

In 2008, the first pan-European skill needs forecast was released involving employment projections by sector, occupation and qualification level across Europe up to 2015. Cedefop's forecasts do not replace skills anticipation and forecasting initiatives taking place at national level. It uses harmonized data and a single methodology to make results comparable across countries which can be aggregated to provide an overall picture of labour market trends and skill development in the EU. In 2009, Cedefop forecast the supply of skilled labour by gender, age group and qualification level.<sup>67</sup> In 2010 the first forecast of skill supply and demand up to 2020 was presented. A later development has been the indicators of skills mismatch.<sup>68</sup>

The pan-European skills demand and supply forecast was based on the multi-sectoral and multi-country model E3ME developed by Cambridge Econometrics. It is designed to provide a forecast of economic trends, resulting in labour demand and supply predictions. It is a large-scale model covering EU-27+ countries. Interaction among economic sectors takes place through input-output relationships and links among countries are formed through international trade equations. The structure of the model includes detailed two-way links among European economies, energy systems and the environment. The econometric specification of the model makes it suitable for short and medium-term forecasting and policy analysis.

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<sup>64</sup> Skills supply and demand in Europe. Medium-term forecast up to 2020. Cedefop. 2010

<sup>65</sup> New Skills for New Jobs. Anticipating and matching labour market and skills needs. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. 2008.

<sup>66</sup> <http://skillspanorama.cedefop.europa.eu/en>

<sup>67</sup> <http://www.Cedefop.europa.eu/EN/about-Cedefop/projects/forecasting-skill-demand-and-supply/forecasting-skill-demand-and-supply.aspx>

<sup>68</sup> <http://www.Cedefop.europa.eu, op.cit>

In the forecasts, the skill demand and supply data were extracted from the labour force surveys (LFS) conducted by the EU member states. The size of national samples is significantly below 1% of the population aged 15-74. For many countries the number of respondents in the LFS within a particular sample cell and for instance, for each occupational group is often low. This means that the estimates of occupational structures within economic sectors cannot be robust. These problems are even more serious when it comes to making estimates of the replacement demand, which requires more data. Nevertheless, LFS data are often the only comparable data available for breaking down employment by occupational group and sub-group of the population. **Table 4** presents LFS sample sizes for some countries of the EU, which are used as a basis for forecasting:

**Table 4: Examples of LFS survey national samples in the EU<sup>69</sup>**

Country	Average number per quarter	% of population 15-74	Country	Average number per quarter	% of population 15-74
BE	22 100	0.3	LU	4 000	1.1
BG	26 000	0.4	HU	60 100	0.8
CZ	49 300	0.6	MT	5 600	1.8
DK	20 700	0.5	NL	83 400	0.7
DE	131 300	0.2	AT	37 900	0.6

#### *Projections of the expansion demand by sector<sup>70</sup>*

The *demand side* projections involved four main modules. Each module contains its own database and models. The results focus on future demand trends at a pan-European level (EU-27+): by sector (up to 41 industries based on NACE<sup>71</sup> classification); by occupation (up to 27 occupations based on ISCO classification); by qualification (three broad levels based on the ISCED classification); and the replacement demand by occupation and qualification. Together these produce estimates of the total numbers of job openings (net growth demand plus replacement demand) by occupation and by qualification.<sup>72</sup>

Forecast of employment by economic sector is provided by a module which is based on results from the above multisectoral macroeconomic model. This model delivers a set of sectoral employment projections, which aim to reflect the assumptions made about the main external influences on the various countries (including technological change and the impact of global competition). The LFS conducted provided information for the analysis of occupational structures by sector. The LFS have the advantage of being conducted regularly and adopting standardised sets of questions and systems of classification.

Cedefop forecasts produced the following principle tables for EU-27+, 2010-2020:

- Sectoral projections of average annual economic output growth per sector;
- Sectoral projections of average annual employment growth;
- Labour force and participation rate projections for different gender and age groups (15-65+);
- Employment trends by ISCO occupational groups;
- Employment trends by 3 broad qualification group (low, medium and high qualification), etc.

The skills demand data were used for producing and comparing across the EU27 group of countries:

- age and gender-based structures of the employed in 60 NACE sectors, and for each occupational group and 149 occupations (ISCO 3-digit);

<sup>69</sup> Skills supply and demand in Europe. Methodological framework. Cedefop. Luxembourg 2012

<sup>70</sup> Based on: Skills supply and demand in Europe. Methodological framework. Cedefop. Luxembourg 2012

<sup>71</sup> Statistical classification of economic activities in the European Community. NACE Rev. 2. Eurostat 2008

<sup>72</sup> Skills supply and demand in Europe. Methodological framework (p.11)

- educational structures of the employed in 60 NACE sectors, and for each occupational group and 149 occupations based on the seven ISCED educational categories, etc.

To estimate probable labour market imbalances and skill mismatches, a module was developed to compare the projections for demand and supply of skilled labour. The results on supply and on demand do not incorporate their interactions and, therefore, cannot be directly compared.

The *employment forecast* for 2010-2020 by industry sector for EU-27+ is presented in **Table 5**. The forecast shows that the total employment growth in Europe over ten years will amount to only 0.3%. However, it does not reduce the demand for educated and trained graduates who will need to make this growth happen and will replace the workers exiting employment. The major absolute growth is forecast in Business and other services and in Distribution and Transport sectors. Employment in Health and Social Work will also increase markedly.

**Table 5. Employment expansion forecast by industry sector, EU-27+, 2010-20**

Industry sectors	Employment (000s)		Changes 2010- 2020	Shares (%)		Expansion (% per annum)
	2010	2020		2010	2020	
<b>Primary sector and utilities</b>	<b>14704</b>	<b>11923</b>	<b>-2782</b>	<b>6.5</b>	<b>5.1</b>	<b>-2.1</b>
<b>Agriculture</b>	<b>12295</b>	<b>9808</b>	<b>-2488</b>	<b>5.4</b>	<b>4.2</b>	<b>-2.2</b>
Mining and quarrying	838	656	-182	0.4	0.3	-2.4
Electricity, gas and water	1571	1459	-112	0.7	0.6	-0.7
<b>Manufacturing</b>	<b>36526</b>	<b>34338</b>	<b>-2188</b>	<b>16.1</b>	<b>14.6</b>	<b>-0.6</b>
Engineering	7458	7125	-333	3.3	3.0	-0.5
<b>Construction</b>	<b>15425</b>	<b>15701</b>	<b>275</b>	<b>6.8</b>	<b>6.7</b>	<b>0.2</b>
<b>Distribution and transport</b>	<b>58773</b>	<b>62179</b>	<b>3406</b>	<b>25.9</b>	<b>26.5</b>	<b>0.6</b>
Hotels and catering	10984	12004	1020	4.8	5.1	0.9
Transport and telecommunications	13601	13949	347	6.0	5.9	0.3
<b>Business and other services</b>	<b>48773</b>	<b>56033</b>	<b>7260</b>	<b>21.5</b>	<b>23.9</b>	<b>1.4</b>
Banking and insurance	5647	5823	176	2.5	2.5	0.3
<b>Non-marketed services</b>	<b>53056</b>	<b>54309</b>	<b>1253</b>	<b>23.3</b>	<b>23.2</b>	<b>0.2</b>
Education	15867	16156	289	7.0	6.9	0.2
Health and social work	22135	23551	1416	9.7	10.0	0.6
<b>All industries</b>	<b>227258</b>	<b>234482</b>	<b>7224</b>	<b>100.0</b>	<b>100.0</b>	<b>0.3</b>

#### *Projection of expansion demand by occupational group*

The employment growth forecast is a basis for estimating future employment by occupational group provided that base-line occupational structures of industries have been identified. **Table 6** presents a forecast for 2010-2020, EU-27+ of the *expansion demand* for occupational groups resulting from industry employment growth. The expansion demand is expressed in the increase or decline of the employment by occupational group per year. The forecast of employment expansion in 2010-2020 was developed for nine major occupational groups and 27 smaller occupational groups (ISCO-08).

**Table 6. Employment expansion forecast by occupational group, 2010-2020, EU-27+<sup>73</sup>**

Occupational groups	Employment (000s)		Expansion demand (% per annum)
	2010	2020	2010-2020
<b>Senior officials and managers</b>	<b>19134</b>	<b>20574</b>	<b>0.8</b>
<b>Professionals</b>	<b>32400</b>	<b>3505</b>	<b>0.8</b>
Physical, mathematical and engineering science professionals	7873	8717	1.0
Teaching professionals	8903	8307	-0.7
<b>Technicians and associate professionals</b>	<b>38332</b>	<b>42803</b>	<b>1.2</b>
Physical and engineering science associate professionals	8689	9440	0.8
Teaching associate professionals	3101	3543	1.3
<b>Clerks</b>	<b>23936</b>	<b>22743</b>	<b>-0.5</b>
Customer services clerks	4522	5179	1.4
<b>Service workers and shop and market sales workers</b>	<b>32088</b>	<b>34283</b>	<b>0.7</b>
Personal and protective services workers	20713	22208	0.7
<b>Skilled agricultural and fishery workers</b>	<b>9710</b>	<b>7674</b>	<b>-2.3</b>
<b>Craft and related trades workers</b>	<b>28672</b>	<b>26529</b>	<b>-0.7</b>
Extraction and building trades workers	12272	12262	0.0
Metal, machinery and related trades workers	10589	9260	-1.3
<b>Plant and machine operators and assemblers</b>	<b>18626</b>	<b>18502</b>	<b>-0.1</b>
Stationary plant and related operators	2217	2325	0.5
Machine operators and assemblers	6883	6636	-0.4
<b>Elementary occupations</b>	<b>23115</b>	<b>25106</b>	<b>0.9</b>
<b>All occupations</b>	<b>227258</b>	<b>234482</b>	<b>0.3</b>

*Estimates of the replacement demand*

The forecast of the replacement demand for skilled workforce is determined by exits from a job/occupation, due to retirements and deaths, transition to non-employment, net migration and inter-occupational mobility. The replacement demand was assessed on the basis of LFS data involving the demographic composition of each occupation. This allows estimating the rates of retirement for each occupational class stocks of age-cohorts by occupation and qualification. It does not permit to estimate transitions from one occupation to another since the data on real turnover of the labour force are unavailable. This model is driven in part by the projected occupational and qualification employment levels, combined with the probability of leaving employment. The replacement demand does not take account of the real labour force behaviour. In the real life, many persons at the age of retirement continue working or return to work. The forecast of the labour force participation rates in the EU27+ has shown that by 2020, 7.6% of the age group of 65+, will continue working what will considerably reduce the replacement demand for skilled workforce.

*Forecast of the total demand for labour force*

Forecast of the total number of job openings as a sum of the expansion demand and replacement demand during 2010-2020 is presented in **Table 7**. The data show that during this period, the replacement demand will constitute around 90% of the total job openings. The expansion demand over this period was estimated as being rather insignificant. Major demand (as % to 2010) for labour

<sup>73</sup> Adapted from: Skills supply and demand in Europe. Medium-term forecast up to 2020. Cedefop. 2010

force is anticipated for occupational groups of senior managers, professionals, technicians, service and sales workers, and craft workers.

**Table 7: Total future demand by occupational group, 2010-2020, EU-27+<sup>74</sup>**

Occupational groups (ISCO-08)	2010 level	Change 2010-20 (000s)			Change 2010-20 (% of the 2010 level)		
		Expansion demand	Replacement demand	Total job openings	Expansion demand	Replacement demand	Total demand
<b>Senior officials and managers</b>	<b>19134</b>	1440	8456	9896	7.5	44.2	51.7
<b>Professionals</b>	<b>32400</b>	2675	12357	15031	8.3	38.1	46.4
Physical, mathematical and engineering science professionals	7873	844	3463	4307	10.7	44.0	54.7
Teaching professionals	8903	-596	3129	2533	-6.7	35.2	28.5
<b>Technicians and associate professionals</b>	<b>38332</b>	4471	10375	14846	11.7	27.1	38.7
Physical and engineering science associate professionals	8689	751	2647	3398	8.6	30.5	39.1
Teaching associate professionals	3101	442	740	1182	14.3	23.9	38.1
<b>Clerks</b>	<b>23936</b>	-1193	6075	4882	-5.0	25.4	20.4
Customer services clerks	4522	657	1436	2093	14.5	31.8	46.3
<b>Service workers and shop and market sales workers</b>	<b>32088</b>	2196	7945	10141	6.8	24.8	31.6
Personal and protective services workers	20713	1496	5169	6665	7.2	25.0	32.2
<b>Skilled agricultural and fishery workers</b>	<b>9710</b>	-2036	2094	58	-21.0	21.6	0.6

<sup>74</sup> Adapted from: Skills supply and demand in Europe. Medium-term forecast up to 2020. Cedefop. 2010

<b>Craft and related trades workers</b>	<b>28672</b>	-2143	12457	10314	-7.5	43.4	36.0
Extraction and building trades workers	12272	-10	7371	7361	-0.1	60.1	60.0
Metal, machinery and related trades workers	10589	-1329	2740	1412	-12.5	25.9	13.3
<b>Plant and machine operators and assemblers</b>	<b>18626</b>	-124	5375	5251	-0.7	28.9	28.2
Stationary plant and related operators	2217	108	1032	1141	4.9	46.6	51.5
Machine operators and assemblers	6883	-247	1758	1511	-3.6	25.5	21.9
<b>Elementary occupations</b>	<b>23115</b>	1991	7958	9949	8.6	34.4	43.0
<b>All occupations</b>	<b>227258</b>	7224	73086	80310	3.2	32.2	35.3

#### *Future demand for labour by qualification levels*

The forecast for the EU-27+ of the demand for labour force for 2000-2020 by qualification level continued applying the three broad qualifications levels constructed on the basis of the ISCED levels as follows:

- Low qualification – (ISCED 0-2): Pre-primary, primary and at most the lower secondary education;
- Medium qualification – (ISCED 3-4): Upper secondary and post- secondary non-tertiary education; This group involves all VET Certificate level qualifications;
- High qualification – (ISCED 5-6): First and second stages of tertiary education which includes technician Diploma qualifications.

**Table 8** summarizes results of forecasting of the demand for qualification levels allowing to draw conclusions on trends in the demand for low-, medium- and high-skilled employees. The demand for low-skilled workers was projected to increase although at lowest rate as compared to other groups. The fastest growth is forecast for high qualifications. As far as the application of this methodology to VET is concerned, it is not useful for the assessment of demand for fresh VET graduates as well as for upgrading qualifications of the employed who are under qualified against their job requirements. The analysis of the demand by qualification should be based on qualifications names since VET programs focus on delivering individual qualifications. VET qualifications in this forecast are divided between the medium (skilled worker Certificates) and high qualifications levels (technician

Diplomas) what puts a barrier to using the forecast for guidance of VET systems. The above qualifications levels should be analysed disaggregated.

**Table 8. Total job openings (expansion and replacement demand) by broad qualification level, 2010-20, EU-27+<sup>75</sup>**

	Levels (000)			Change (%)		
	Expansion	Replacement	Total job openings	Expansion	Replacement	Total job openings
Professionals						
Low qualifications	-12054	18132	6078	-23.2	34.9	11.7
Medium qualifications	3668	33808	37475	3.3	30.1	33.3
High qualifications	15610	21142	36757	24.8	33.6	58.4
<b>All qualifications</b>	<b>7224</b>	<b>73066</b>	<b>80310</b>	<b>3.2</b>	<b>32.2</b>	<b>35.3</b>

#### *Modelling skills supply*

The practice of modelling skills supply involves analysis of both stocks of labour force and its flows. Stocks in one period are related to stocks in an earlier period, plus inflows and less any outflows. The source of data for Cedefop modelling of skill supply was econometric analysis of national LFS data. The skill supply projections are broken down by age, gender and formal qualification and cover the population and labour force aged 15 and over. The account is taken of the continuous efforts to increase labour market participation, in particular of women and older people what will increase the supply. The projections are presented in the format compatible with the skills demand projections.

The forecast of supply focuses on stocks of people by three broad qualification levels (high, medium and low) and flows of those undertaking courses and acquiring qualifications. The future supply of skilled workforce is structured by highest qualification held as well as by age group and gender for the whole population aged 15 and over, and the labour force aged 15 and over. The forecast estimates labour supply as a function of economic activity, real wage rates, unemployment, etc. Estimates are made for labour market participation in each country by gender and separately for different age groups. This is important for modelling educational participation and attainment since these are gender and age specific.

The labour supply data cover the following dimensions:

- employment status (employed, unemployed, inactive);
- 149 occupational sub-groups (ISCO 3-digit) for the employed;
- seven educational categories (ISCED categories 0-1, 2, 3 short, 3 other, 4, 5, and 6);
- five-year age cohorts (15-19, 20-24, ..., 65-69, 70+) resulting in 12 groups;
- gender variables.

In general, the labour supply is determined by demographic developments, labour market participation and levels of educational attainment. Cedefop model focuses upon patterns in the qualifications currently held as reported in the LFS. These patterns are then applied to projections of the population aged 15+ and to the labour force, each differentiated by age and gender. The projected shares of educational attainment by gender and age groups are applied to the *projections* of the working age population for the same age and gender categories. This generates forecasts of the numbers of people in the working age population by highest qualification held, broken down by age and gender.

<sup>75</sup> Adapted from: Skills supply and demand in Europe: Medium-term forecast up to 2020. Cedefop 2010

The overall supply of people holding formal qualifications at higher level (ISCED 5-6) is relatively straightforward to be used in the forecasting of educated and skilled workforce. However, there are difficulties in modelling the supply of the lower levels of education as the lower qualified may increase their educational level during the working life and the initial stock may change in the future. Forecasting by occupation and qualification, economic sector and geographical area is even more difficult. The forecast was made of the change of qualifications levels by age and gender groups. The forecast on the supply of the labour force by the level of educational attainment for selected EU member-states was also made (see **Table 9**). The table shows that the share of the labour force (15+) in 2020 will have greater shares of persons holding educational attainment levels belonging to ISCED medium and high qualifications. However, this table is unable to provide any details on VET qualifications which are spread between the two ranges of qualifications which are forecast to gain.

**Table 9: Labour force (15+) by country and qualification, 2010-20<sup>76</sup>**

	Low qualifications (000)			Medium qualifications (000)			High qualifications (000)		
	2010	2020	Change	2010	2020	Change	2010	2020	Change
Belgium	1014	680	-334	1883	1965	82	1826	2158	332
Bulgaria	500	294	-206	2111	2082	-29	899	975	76
Germany	6384	5139	-1245	24786	24716	-70	10287	10960	673
France	6467	4646	-1821	12229	11914	-315	8833	11227	2394
Italy	8702	8140	-2562	11393	12638	1245	4264	5753	1489
UK	5905	2858	-3047	14899	17149	2250	10472	12656	2184
<b>EU-27+</b>	<b>54527</b>	<b>39501</b>	<b>-15026</b>	<b>121114</b>	<b>123861</b>	<b>10628</b>	<b>67234</b>	<b>82542</b>	<b>15308</b>

The size and structure of the labour force is eventually dependent on the labour force participation rates by age group, gender and qualifications levels. The participation rates were forecast as well.

#### *Attempts to reconcile skills supply and demand<sup>77</sup>*

One of the major aims of anticipating the demand and supply of labour is to uncover potential future imbalances between them (by occupation). The demand-side forecast of future needs of industry in occupations is compared with the independent supply-side forecast of labour supply by occupation. The gap is viewed as an anticipated difference between the demand and supply. The projected overall numbers of the labour supply are taken as given since they are largely predetermined by demography. The much better qualified new labour market entrants will replace the less well qualified older people, with substantial improvements in average qualification levels. In the Cedefop forecast for 2010-2020, a further module has been added which confronts skill demand and skill supply projections by qualification and is trying to identify potential mismatches and reconcile the two.

The identified difficulties for comparing demand and supply of skilled labour include:

- double jobbing (some people have more than one job) or one full-time job is shared by two or more people;
- distinction between residence and workplace (many people do not live in the same country as they work; this is especially significant for countries with considerable outgoing migration flows);
- participants in training and education who are also working (they may simultaneously be included in the labour force as well as in education statistics).

<sup>76</sup> Adapted from: Skills supply and demand in Europe: Medium-term forecast up to 2020. Cedefop 2010

<sup>77</sup> Skills supply and demand in Europe: Medium-term forecast up to 2020. Cedefop 2010

The major approach to balancing labour markets is that the labour supply (involving VET graduates) should be able to satisfy the unfulfilled demand. Some mismatch indicators were proposed of possible imbalances in the labour market including:<sup>78</sup>

- overall imbalances: an oversupply or undersupply, be it by education level or in total;
- under and over qualification and occupational mismatches;
- unemployment rates by education level as an indirect indicator of mismatches; high levels of unemployment mean that the supply cannot be properly matched to the limited demand, etc. (see the list of mismatch indicators in **Table 1**).

The above experience of Cedefop demonstrates the availability of concepts, statistical instruments and models for conducting labour market forecasts. However, no advice is offered for applying the results of this considerable work to the supply of skilled workforce from VET.

#### IV.2 Labour market forecasts in EU member states

##### *Assessment of demand and supply of occupations in Austria<sup>79</sup>*

In Austria, the national labour market service organization (AMS) introduced a “skills barometer” to provide the different users with information on current and medium-term demand for occupations and qualifications. The skills barometer is a web-based labour-market information tool aiming at informing on the current situation and future trends for different occupations and required skills. Among users there are individuals, labour-market counsellors, enterprises and policy-makers.

The skills barometer utilizes the occupational classification involving 24 areas, 95 occupational fields and several occupations in each field resulting in overall some 600 occupations. The 600 occupations are structured as combinations of some 8,000 detailed skills. Similar to occupational areas the AMS-skills barometer defines 23 skill areas, which are again divided into approximately 230 skills at the level of occupational fields. Every occupational field integrates information on relevant knowledge, skills and abilities.

The AMS-skills barometer also provides regional labour-market information for the nine provinces. The limited database will be improved by using a regular employer surveys carried out by the AMS. The AMS-skills barometer delivers information for occupations and skills at a highly detailed level. For each of the 24 occupational areas and 95 occupational fields, labour market needs and trends are illustrated. For each occupation, the barometer provides estimates of numbers of jobs available in the previous 2 years as well as the current vacancies and forecasts. The sources of information are both quantitative and qualitative involving:

- annual analysis of job advertisements commissioned by the AMS;
- data on job vacancies;
- results of regular enterprise survey in more than 20 000 firms with at least 20 employees which is carried out by regional offices of AMS; the survey compiles quantitative information on skills and competences;
- national level labour-market statistics from Statistics Austria, public insurance association, etc.;
- analyses and forecasts on skills demand in labour market (at regional and national level).

<sup>78</sup> Future skills supply and demand in Europe: Methodological framework. Research paper No. 25, Cedefop 2012. Luxembourg. [http://www.Cedefop.europa.eu/EN/Files/5525\\_en.pdf](http://www.Cedefop.europa.eu/EN/Files/5525_en.pdf)

<sup>79</sup> S. Humpl and D. Bacher: The AMS-skills barometer: a web-based labour-market tool. Making use of forecast results by stakeholders. In: Building on skills forecasts. Comparing methods and applications. Conference proceedings. Research paper No 18. Cedefop. 2012

AMS has a standing committee which organizes three yearly sectoral discussions between experts, company representatives and educational providers for 10 different sectors enabling to review the AMS-skills barometer.

*Demand and supply of educated workforce in Norway*<sup>80</sup>

Norway has seen a considerable growth in demand for labour with higher skills and educational levels. Labour supply has followed demand rather closely. Maintaining stability in the labour market requires that labour demand and supply continue matching in the future. Statistics Norway has been developing projections on demand and supply of labour by education since 1993. The most recent forecast produced projections of the demand and supply of labour towards 2030. Forecasts are based on a macroeconomic model involving input-output interaction between the different industries. The labour force is structured into five educational groups. Performance of industry sectors is seen as dependent on the macroeconomic functioning of the national economy, on availability of natural resources and the further growth in public services. In addition, demand for labour force in industries is viewed as driven by technological progress. The aggregate *demand for labour* in each industry is further structured by *educational fields* using assumptions of how the employment shares within each main educational group may develop. It was assumed that the trends observed in the past decade regarding the educational composition of labour will continue. The demand side national projections correspond rather closely to the projections produced for EU-27 by Cedefop (see above).

The need for the future supply of the labour force which is structured by education level, is identified by linking equations for labour-market participation by age and gender to the existing structures of the labour force taking account of the demographic structure of the labour force. From a representative sample of the population in a base year, the model simulates the future labour market trajectories of the population. The projections show what will happen if everything continues as was recently observed including the people's behaviour in the area of education.

The effects of economic development of Norway on labour demand were forecasted until 2030 on the basis of national accounts. The assumption was that there will be a quick adjustment from the low national economic growth observed through 2009 to a more balanced economic development where employment, wages, consumption, prices and activities grow at rates close to the prevailing trend. This will have certain implications to the demand for educated and skilled labour.

During 2004-08 there was an extensive labour supply growth which was also accompanied by the increase of labour force participation rates. Due to aging population, the labour market participation rates are forecast to decrease from 73% to 70% towards 2030. The supply of workforce will be supported by the high immigration inflows. This would result in a certain consistency between the demand and supply of labour force. By 2030, the demand for labour will increase mainly from the public health and social sector as the share of elderly population will continue growing.

The projected demand for employment from industries for each of the five educational groups in percent of the total employment was estimated. It is forecast that the trends of increasing demand for skilled labour will continue while a demand for less-educated workers will decline. The increase of educational levels of the labour force will continue. The share of the employed with primary or lower secondary education being in 2007 about 27%, is anticipated to decline to 18% in 2030. A share of employees with the upper secondary vocational education will increase from 25% to 30%.

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<sup>80</sup> Demand and supply of labour by education in Norway towards 2030. Linking demographic and macroeconomic models. In: Building on skills forecasts., op.cit.

Shares of labour force by field of education in economic sectors were estimated and a forecast of the sectoral demand by field of education by 2030 was produced. It was assumed that the occupational structures by field of education will not change by the end of the forecasting period. As a result, *the demand for persons with specialisation in electronics, mechanics and machinery and in some other fields is predicted to show the strongest growth. For these fields, employment is projected to increase by nearly 65 000 persons from 2006 to 2030. It is forecast, that by 2030, workers with an education in electronics, mechanical work and machinery may constitute the largest group of vocational education at higher secondary level, with a share of nearly 30%.* The employment of persons with specialisation in nursing and caregiving, building and construction is also expected to increase.

The labour supply was compared with labour demand and projected on the basis of modelling individual labour market trajectories taking account of the labour force participation rates. Probabilities of such trajectories are estimated on the basis of observed transitions in a base year for a representative sample of the population. Events included in the simulation are migration, deaths, births, marriages, divorces, educational activities, labour force participation and retirement. Education serves as an important factor for different kinds of transitions. Projections of future demand and supply of workforce by education is an ongoing activity.

#### *Forecasting labour with vocational skills in Germany*<sup>81</sup>

German classification of occupational fields was applied to both the demand and the supply side of labour market. It consists of 54 occupational fields which are grouped at the level of the occupational categories (three-digit codes) from the German classification of occupations 1992 (KldB 92) on the basis of comparable job characteristics. 12 occupational fields are considered as major occupational fields (MOF).

German classification of vocational education and training levels of the labour force involves four skill levels (as measured by highest formal qualification) following the ISCED classification, namely:

- (a) people with no vocational qualification (ISCED 1, 2, 3a);
- (b) people with a skilled initial vocational qualification (ISCED 3b, 4);
- (c) people with a master craftsman, technical engineer or a trade and technical school qualification (ISCED 5b);
- (d) people with an academic degree (ISCED 5a, 6).

The *demand projection* was based upon employment structures and size during 1996 -2006 resulting in the demand (persons in employment) up to 2025 produced for 59 industrial sectors and 54 occupational fields. Within each occupational field all persons in employment are disaggregated into four education levels (according to highest formal qualification).

Modelling allowed computing shares of people who possessed MOF for which they were originally trained as well as the shares of people who shifted from the acquired occupation into another MOF (due to occupational mobility). This mobility is reflected by the *occupational flexibility matrix*. The occupational flexibility is assumed to be stable for the whole forecasting period for the four education levels and three age cohorts (15 - 34, 35 -49 and 50+). Hence, future participants of the labour force are distributed into the 12 MOF according to their education-specific (initial vocational qualification), skill specific (highest formal qualification) and age-specific occupational flexibility.

So far, no instruments have been developed to quantify the interaction between the labour force demand and supply. The occupational flexibility matrix gives no explanation of the mobility patterns

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<sup>81</sup> T. Majjer: "Methods and results of skills demand and supply forecasting. The case of Germany" In: Building on skills forecasts, op.cit.

but makes it possible to show which kinds of labour market transitions take place for persons with certain vocational attainment level and employed in certain occupational areas. A fragment of the German occupational flexibility matrix produced for 5 out of 12 MOF presented in **Table 10** shows that only around half of the vocational graduates from MOF Group 1 “Raw materials extraction” will eventually work in the occupational area in which they had been trained while some 13% of graduates will take jobs in the warehousing, transport and security sector. These data serve as an important input in calculating necessary enrolments and graduations enabling to reduce the supply-demand mismatches.

**Table 10. Occupational flexibility matrix for major occupational fields (MOF) in Germany**

No. of MOF	Vocational education in one of the MOF	Shares of graduates employed in MOF (%)				
		1	2	3	4	5
1	Raw material extraction	49,5	8.6	3.0	6.3	12.8
2	Processing, manufacturing and repair	1.9	46.3	7.8	6.2	15.6
3	Control and maintenance of machines and plants	1.3	14.0	44.3	5.2	11.9
4	Trading and sales	0.8	2.9	1.2	50.4	6.2
5	Warehousing, transport, security	1.1	6.1	2.0	4.3	65.3

*Using the results of forecast for planning of education enrolments in Finland<sup>82</sup>*

In Finland, the “basic scenario” of VET enrolments involves estimates of the numbers of youth who need training because of the size of population. These estimates represent the “demand for training” rather than the “demand for skilled labour force”. The enrolment demand is structured by education level: upper secondary VET, polytechnic degree, and university degree. However, the industry demand-related enrolment (called “target scenario”) is based on recognition that employment size by sector tends to change due to the following trends: manufacturing industry and industrial services will face a decrease, whereas the number of jobs in services and human health and social work activities will grow. Student enrolments which are linked to labour market demand-based forecasts of occupational structures for different industries are planned by fields of education and by individual occupations. For instance, if the enrolment for Tourism, Catering and Domestic Services is projected at the level of 10,400, further efforts still need to be made to identify the occupations and qualifications the graduates will need to be produced. Due to the expected employment growth in business activities, education and research, the focus was to be placed on planning of HE enrolments rather than on VET because of the qualifications structures of these sectors. It is emphasized, however, that the enrolment targets of the Ministry of Education and Culture *will not be immediately and directly aligned with the anticipation results.*

The labour market forecast in Finland helped to identify:

- that the supply of fresh graduates by 2025 will not be enough to satisfy the needs of the economy even if the economy and employment were to grow in line with historical trends;

<sup>82</sup> Education, training, and demand for labour in Finland by 2025. Finnish National Board of Education. 2012 (see Annexes 5-7).

- that the fresh annual outcome of graduates will not be sufficient even for satisfying the replacement demand;
- the differences between the student demand for educational and training enrolments and the industry future demand for graduates; in some areas of study the need for considerable reduction of future enrolments have been identified.

### IV.3 Anticipation of future occupational demand in the US

#### *Projecting occupational employment*

Every two years, the Bureau of Labour Statistics (BLS) in the US publishes projections for the labor force, macroeconomy, industry employment, and occupational employment. The projections data provide an overview of expected changes in the economy over a 10-year period. The projections are focused on long-term structural trends of the economy. Critical to the production of these projections is the assumption of full employment for the economy in the projected year. The projections are not intended to be a forecast of what the future will be but instead are a description of what would be expected to happen under these specific assumptions and circumstances. When these assumptions are not realized, actual values will differ from projections.

The difference between projected changes in the labor force and in employment does not necessarily mean a labor shortage or surplus. The BLS projections assume labor market equilibrium; that is, one in which labor supply meets labor demand except for some level of frictional unemployment. In addition, the employment and labor force measures use different definitional and statistical concepts. For example, employment is a count of jobs, and one person may hold more than one job. Labor force is a count of employed people, and a person is counted only once regardless of how many jobs he or she holds.<sup>83</sup>

BLS projections of industry and occupational employment are developed in a series of six interrelated steps, each of which is based on a different procedure and assumptions:

- labor force (total and by age, sex, race and ethnicity);
- aggregate economy (GDP, total employment, and major demand categories);
- industry demand, sales;
- occupational employment (job openings due to growth & separations);
- Industry employment (labor productivity, average weekly hours, wage & salary employment);
- Industry output.

Nonfarm wage and salary employment is covered by the Occupational Employment Statistics program (OES) in conjunction with data from the Current Employment Statistics program (CES) and the Quarterly Census of Employment Wages (QCEW). Agricultural industry employment, self-employed workers, and workers in private households are covered by the Current Population Survey (CPS). Projections of job growth provide valuable insight into future employment opportunities because each new job created is an opening for a worker entering an occupation. However, opportunities also result when workers separate from their jobs, either to find employment in other occupations or to leave the labor force entirely (see the para on assessment of *replacement demand* below).

A major input to the analysis of demand for skilled workforce is provided by the Occupational Employment Statistics (OES) survey which is administered by the BLS.<sup>84</sup> The survey measures occupational employment and wage rates for wage and salary workers in nonfarm establishments

<sup>83</sup> <https://www.bls.gov/news.release/ecopro.tn.htm> (accessed on 01.03.18)

<sup>84</sup> [www.bls.gov/oes/current/methods\\_statement.pdf](http://www.bls.gov/oes/current/methods_statement.pdf). (accessed 01.03.18)

nationally, and in the 50 states. About 7.5 million in-scope establishments are stratified within their respective states, industry, and ownership on the basis of North American Industry Classification System (NAICS). The survey sample is designed to represent all nonfarm establishments in the US. Employers are required by law to file unemployment insurance (UI) reports to the state workforce agencies. Every quarter, BLS combines unemployment insurance reports from the states into a single database called the Quarterly Census of Employment and Wages (QCEW). Every six months, OES extracts the administrative data for establishments that are in scope for the OES survey from the most current QCEW. Panels of about 200,000 establishments are selected semi-annually. Estimates of occupational employment and wage rates are based on six panels of survey data collected over a 3-year cycle. The final survey sample size when six panels are combined is approximately 1.2 million establishments covering some 81 million of the total national employment of 139 million.

Responses to the questionnaire from establishments are obtained by mail, Internet or other electronic means, email, telephone, or personal visit. Respondents report their number of employees by occupation across 12 wage groups. The OES survey includes all full - and part -time wage and salary workers in nonfarm industries. Self-employed workers, owners and partners in unincorporated firms, household workers, and unpaid family workers are excluded. Occupations are classified based on work performed and on required skills. The Standard Occupational Classification (SOC) system<sup>85</sup> is used to define occupations. Employees are assigned to an occupation based on the work they perform and not on their education or training. Employees who perform the duties of two or more occupations are reported in the occupation that requires the highest level of skill or in the occupation where the most time is spent.

In 2016, a QCEW response rate to the questionnaire on the occupational employment was 72.8 percent. To partially compensate for nonresponse, the missing data for each nonrespondent are repaired using plausible data from responding units with similar characteristics. Occupational employment estimates are produced by geographic area, industry group, and size of establishment. The OES survey has been a major source of detailed occupational employment data for many users, including individuals and organizations engaged in planning VET and HE programs, and short-term labour market training programs. OES data also are used to prepare information for career counseling, and job placement activities, etc.

BLS creates occupational employment projections in a product called the National Employment Matrix. This matrix describes the employment of detailed occupations within detailed wage and salary industries and different classes-of-workers, including those who are self-employed or employed by a private household. The matrix provides a comprehensive count of nonfarm wage and salary jobs (which is different from a count of workers since a single worker may hold more than one job) and a count of self-employed workers, agricultural industry workers, and workers employed in private households. These counts are provided for a base-year and a projected-year which is ten years in the future.

#### *Replacement demand*

BLS projects occupational separations using two different models, one for labor force exits and another for occupational turnover. Both models analyse historical data to identify the characteristics of a worker, such as age and educational attainment, that make them likely to separate from their occupations. These patterns based on historical data are then applied to the current employment for each occupation to project future separations. This new method for forecasting the occupational separations was first used with the 2016–26 projections. Projections of separations are combined with projections of employment change to determine occupational openings. The estimate of openings does not count workers who change jobs but remain in the same occupation. In most

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<sup>85</sup> [www.bls.gov/soc/](http://www.bls.gov/soc/)

occupations, the openings caused by separating employees provide more job openings than employment growth does. The national forecast of job openings in the US until 2026 shows that 60% of annual job openings in the US will result from occupational turnover.<sup>86</sup>

*Occupational Outlook Handbook, 2016-2026*<sup>87</sup>

On the basis of the above data and projections BLS produces annually the Occupational Outlook Handbook which provides information about several hundred occupations. It includes a description of the occupation (job summary), the entry-level education and training required, annual pay level and job outlook. Such information is available for each occupation in different States and localities. The Occupational Outlook Handbook is designed to help private individuals, and career and guidance officers. **Table 11** provides an example of the information from Occupational Outlook Handbook.

**Table 11: Projected employment, education entry, wage, and job outlook for selected occupations, USA, 2016-2026**

Occupations		Job summary	Entry-level education	2016 Job outlook and median pay
1	Automotive Service Technicians and Mechanics	Automotive service technicians and mechanics, often called <i>service technicians</i> or <i>service techs</i> , inspect, maintain, and repair cars and light trucks.	Postsecondary nondegree award	Number of jobs in 2016 (749,900). Job growth of 6% (average) Median pay: \$38,470
2	Medical Equipment Repairers	Install, maintain, and repair patient care equipment.	Associate's degree	Number of jobs (47,100) Job growth of 4% (slower than average) Median pay: \$48,070
3	Line installers and repairers	Install or repair electrical power systems and telecommunications cables, including fiber optics.	High school diploma or equivalent	Number of jobs (227,000) Job growth of 8% (average) Median pay: \$62,650

<sup>86</sup> [https://www.bls.gov/emp/ep\\_table\\_110.htm](https://www.bls.gov/emp/ep_table_110.htm)

<sup>87</sup> <http://www.bls.gov/ooh/> (Accessed on 01.03.2018)

## V. REGIONAL EXPERIENCE OF PLANNING OF VOCATIONAL ENROLMENTS

### V.1 Regional VET planning in Australia

VET authorities in Australian states and territories have the responsibility for managing the purchasing of training. The processes through which the purchasing plans and profiles are developed and the balance of factors that influence the plans vary across states and territories. The state and territory level infrastructure for VET enrolments planning is quite complex. In Australian States, there are three major sources of information used in the regional planning of the supply of VET delivered by the registered training organizations (RTOs). The networks of the Training and Further Education (TAFE) institutes are an important element of the training planning. The institutes have their own formal and informal industry links and networks and are able to gather information about student demand and preferences. TAFE institutes are required to regularly produce the so-called “environmental scans” which present data on the demographic dimensions, employment and training markets within the physical reach of each TAFE institute.<sup>88</sup> Such environmental scans present opinions of TAFE institutes on the current and anticipated demand for occupational graduates. TAFE colleges gather information through formal and informal links with industry and other agencies and through analysis of student demand and their labour market destinations.

For instance, the VET delivery planning process in the State of Victoria uses sets of regional Area Study and Industry Study reports to negotiate performance agreements between the government department and each TAFE college. The area studies identify regional duplication and gaps in the VET provision by type of programme. The industry sector studies, combined with econometric analyses, inform calculations of shares of the publicly funded training by industry sector. The two sets of studies inform calculations of shifts in occupational profile across industries in the region. These calculations are based upon the following criteria: industry skill development needs (skills gaps), skill shortages and net replacement rates that require new entrants to occupations. In Victoria, the regional data gathering through surveys and interviews is moderated through industry advice, including input from the Industry Training and Advisory (ITABs) and advice from the VET providers. These analyses then provide the basis for negotiations between the respective tertiary education offices of the state government and each individual TAFE institute.<sup>89</sup>

All states and territories include programs that are delivered through competitive processes (contestable funding) and that are outside the so-called user choice which is the student demand-driven VET. In most cases, the share of these programs in the overall VET budgets is not great, and mostly it ranges between 4 -10 % of the overall State VET allocations. Contestable funds typically are allocated through special programs that mostly are directed towards critical regional shortages for skilled workforce and industry training needs, and the needs of social groups or communities. The combination of 'critical skills' and 'strategic priorities' is suggested in the titles of these programs.

The contestable funds are designed to target: key industries and developments; types of industries, such as rural and small businesses; key industry areas, such as manufacturing; types of workers, such as seasonal and rural workers; and equity groups. In many cases the targeting is associated with major economic and social policies, priorities and strategies.

The following sources of information are utilized by TAFE institutes in planning the training supply:

- institute/college industry committees or reference groups;
- linkages with and feedback from employers that recruit graduates from the college;

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<sup>88</sup> Environmental scan for the national strategy for vocational education and training. 2004-2010. ANTA 2002

<sup>89</sup> J. Keating. Current vocational education and training strategies and responsiveness to emerging skills shortages and surpluses. NCVET. 2008

- the use of national and sectoral labour market data and industry reports commissioned by the government and/or implemented by the Australian Bureau of Statistics (ABS);
- advice and feedback from the state training department that is gained in the negotiations over the funding and performance agreements;
- the use of environmental scans that are initiated either by the institute or the training authority.

In many cases, regional providers were identified involved in delivery of the same VET programs in small regions or sub-regions, what has allowed to rationalize the delivery profiles between the institutes helping to avoid excessive enrolments.

#### *Data for planning of training*

State authorities use sets of quantitative data on skills needs and industry and occupational trends at state and sub-regional levels. The data include the information collected by the relevant ministry responsible for VET, other ABS data, the Australian Vocational Education and Training Management Information Statistical Standard (AVETMISS) data and the data gathered at the state or territory level. In several, if not most, cases these data analyses are quite detailed and employ sophisticated modelling systems.

Authorities supplement the survey-based quantitative data with a range of data gathered through other means. These data include the input of the TAFE institute and college strategic plans and proposed their training profiles, which in turn are based upon local analysis. This is an important source of information, but it also has its limitations. There is a tendency for many institutes and colleges to display path dependency and to have a limited market outlook, and this is in part conditioned by the difficulty in changing VET institutions' staff and programme delivery profiles in line with the labour market and student demand for training. Nevertheless, the negotiations between the state VET department and the individual providers is a key in the planning process.

VET delivery is influenced by state and territory economic and social strategies and priorities. Strategies and statements that impact on VET delivery may be issued by the VET department or jointly issued by several departments. The use of multiple data sources at all levels in the planning and resource allocation processes is important. The practice of gaining information on both regional and industry sector and occupational needs is a useful approach. It is important to have providers that are geared to both current and anticipated market demand what remains a major challenge to the VET sector.

The government implemented new arrangements to improve VET system's responsiveness to the needs of industry and focus investment on where it is most needed and where there is the greatest public benefit. More than 220 courses received increased public subsidies per hour funding rate, including all courses undertaken as part of an apprenticeship. Other courses, where there are indications *of a comparatively lower return to the economy and students*, received lower public subsidies.<sup>90</sup> Higher benchmark hourly rates have been attributed to the foundation and apprenticeship qualifications, and lower funding rates – to diplomas and above (where income contingent student loans are available) and to lower-level certificates where direct benefit to graduates is lower. The public value of courses has been assessed on the basis of its value to the economy (in terms of jobs or productivity) and the extent to which government investment is required to stimulate delivery of, and participation in, this training to meet industry needs.

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<sup>90</sup> <http://www.education.vic.gov.au/Documents/about/department/vetsubsidies.pdf>

The major instrument used in Australia for *forecasting of the training demand* is the CEET<sup>91</sup> model, in which employment expansion forecasts are based on the MONASH University model run and maintained by the Centre of Policy Studies (CoPS). The MONASH model is a large dynamic computable general equilibrium (CGE) model that produces forecasts of employment by industry and occupation. Its input includes a range of historical data (e.g. Census, national accounts, input-output tables, state accounts, foreign trade, capital stock, income and expenditure surveys etc.).

Other inputs to forecasting are also provided from:

- Deloitte Access Economics' (DAE) 5-year macro forecasts of output by major industry sector<sup>92</sup>;
- Australian Bureau of Agricultural and Resource Economics' (ABARE) export prices and volumes for primary products;
- Tourism Forecasting Council's (TFC) assessment of the prospects in the tourism industry;
- CoPS assessment of changes in technology and consumer tastes etc.

## V.2 Anticipation of regional training demand in France<sup>93</sup>

Anticipating economic changes has become a central issue for regional stakeholders in France. The forecasting exercise was led by the regional observatory of training and employment (ORFE<sup>94</sup>) in order to anticipate labour force needs until 2020. The scope of the forecast involved both the entry level training courses for young people but also training of the employed and job-seekers. The impact of economic development in the region on employment and training needs was analysed. The projection also aimed to anticipate the impact of economic growth on job creation. ORFE proposed a medium-term employment projection model, which allowed identification of how the creation of jobs influenced the job market. Since 2001, detailed regional analysis was implemented involving occupations and sectors of activity. The model relied on the two ORFE tools: the Cahiers, that seeks to reveal the trends at work and their impact on employment and training, and the regional indicators of employment and training (IREF). The model was created through the work undertaken for the Plan régional de développement des formations (PRDF 2003-10) [Regional plan for training development), worked out in the central region of France.

Three scenarios were proposed for the period till 2020:

- (a) a stability projection assuming that the region after the economic crisis will maintain the growth rate observed between 2001 and 2005 until 2020;
- (b) a favourable projection assuming that the economic growth rate observed between 2005 and 2007 would continue until 2020. The centre region would then come back to the national average growth;
- (c) a crisis projection.

The employment projections for each economic sector and industries were developed in relation to the three different scenarios. The *stability projection* would result in negative job creation in industry. Job creation would be quite moderate in the tertiary sector and construction. The *relative growth* scenario would generate significant job creation in the sectors of construction, transportation, and services for companies (counselling, assistance and operational services). In education, health, and social work, planned job creation was more moderate. The *crisis* scenario, a

<sup>91</sup> Centre for the Economics of Education & Training (CEET). Melbourne. Australia

<sup>92</sup> Economic modelling of skills demand and supply. Australian Workforce and Productivity Agency. Report by Deloitte Access Economics. July 2012

<sup>93</sup> Marie-Béatrice Rochard: How to anticipate the evolution of qualifications and training needs: a regional point of view. In: Building on skills forecasts., op.cit.

<sup>94</sup> Observatoire régional formation emploi (Regional observatory of training and employment).

continuation of the trend between 2007 and 2009, shows how important job losses could be in all sectors.

*The future demand for additional workforce* is calculated as a sum of net job creation (future regional employment estimated by the model for 2020 minus employment levels observed in 2007) (interpreted as “expansion demand”) and of the estimate of future retirement of the regional workforce (interpreted as “replacement demand”). In the *stability scenario*, the future demand for additional labour force will be very limited. However, although job creation in industry will remain limited, the additional recruitment could be a problem because of extensive retirement in the transport sector, counselling and assistance services, as well as in construction, retail, health, and public administration. For the relative *growth scenario*, recruitment needs of industry will increase slightly. However, they will increase significantly in construction, transportation, counselling and assistance and operational services, as a result of job creation and labour force retirement. Finally, in the *crisis scenario*, there will be mainly job losses in industry, transportation, etc.

The National Employment Office (Pôle Emploi) and training organisations have been consulted to measure the employment tension rate for the critical jobs in the region as follows: number of vacancies in the occupation/ applicants for jobs in the same occupation) (“Beveridge criterion”, see also **Table 1**). Since not all job vacancies are reported to Pôle Emploi, the ratio tends to underestimate the tension rate.<sup>95</sup> Some of the jobs were “in tension” at the time of crisis as well. The jobs with high tension rates (vacancies exceeded numbers of qualified applicants) were examined and the training avenues leading to the relevant occupations were identified. Tension rates for some occupations are summarised in **Table 12**. This tool, updated annually, is used for monitoring the employment situation with selected occupations, the need for recruitment, and the availability of initial training programme offers.

**Table 12: Tension rates for selected occupations in a region of France**

Occupations	2007			2009		
	Vacancies	Applicants	Tension rate	Vacancies	Applicants	Tension rate
52332 – Maintenance technician for thermic, climatic and refrigerating systems	328	204	1.6	266	329	0.8
52333- Electronics maintenance technician	292	241	1.2	200	283	0.7
45212- Operator of metal production	83	66	1.3	8	78	0.1
44132- Solderer	953	908	1.1	406	1172	0.3

## VI. CONCLUSIONS: APPLICABILITY OF LABOUR MARKET ANALYSIS AND FORECASTING TO VET

### *Current demand for skilled workforce versus long-term forecasts*

The ultimate purpose of skills forecasting is to make predictions about future imbalances of demand and supply. Most of of labour force forecasts are for 5-20 years. In the countries with developed

<sup>95</sup> Apparently not all job seekers register with employment offices as well

systems of data collection and processing, it has become possible to identify and model trends of growth or decline in future demand for educational and VET qualifications on the basis of the past trends and forecasted economic growth and demography.<sup>96</sup> The forecasts did not intend or have been unable to offer practical solutions for mitigating the increasing mismatch between demand and supply through, for instance, modifying the educational supply processes and structures. It is expected that the labour markets will resolve the imbalances by themselves through a limited range of internal adjustment mechanisms (see **Section II.**).

Further, the forecasting models involving flows of skilled workforce are very demanding on labour market behavioural data and therefore the forecasts in all countries mostly focus on the analysis of the available *stock of labour by ISCED educational level*.<sup>97</sup> As a result, estimates of inflows of graduates to the labour market also need to be structured by ISCED level. This reduces the value of such estimates for VET systems which plan enrolments by occupational qualification. The *educational structures* applied in forecasts ignore vocational awards. Educational qualifications are structured into the three ISCED levels the way which splits the VET qualifications into 2 groups: Certificates of skilled workers were put into the medium level qualifications, while the technician Diplomas are merged with the HE awards. Labour force forecasts have the potential, however, to advise on probable future shortages or surpluses of skilled workforce in comparison with national demographic forecasts. They can be very useful for advising migration policies when future shortage of the national workforce is anticipated.

In practice, VET systems are concerned with the *current* or very short-term (up to 3 years), rather than future, demand for skilled workforce and related TVET enrolments which need to be developed or financed from public budgets. The focus on short-term analysis is justified by the fact that full-time Certificate level programmes commonly last for around 12 months while technician education programs require some 3 years. Many developing countries do not have the potential and sufficient labour market information to model their economic growth, the labour market demand and supply and may need to focus on acquiring capabilities for the analysis of current and short-term demand for skilled workforce and on risks of mismatch.<sup>98</sup>

The approaches to the analysis and interpretation of the *current demand* for skilled labour yet need to be developed for producing regular guidance on publicly financed VET enrolments. The regular national and sectoral labour market forecasts are implemented by specialist national bodies. However, there is no clarity regarding the organizations which may be assigned the mandate for conducting analysis of the current demand for skilled labour in regions. It is suggested to become one of the functions of PES.<sup>99</sup> Some other proposals have been made that PES should also carry out the forecasts of the demand for skilled workforce and act directly on identification and reducing mismatches in the labour markets.<sup>100</sup> However, PES may have low capability to influence VET systems which manage the supply side and therefore the suggested role of PES may be less effective.

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<sup>96</sup> See, for instance, The Occupational Outlook Handbook, 2016-2026, US. <http://www.bls.gov/ooh/> (Accessed on 01.03.2018)

<sup>97</sup> See for instance, on the experience of allocation of educational fields in the labour market forecast in the Netherlands: "Guide to anticipating and matching skills and jobs. Developing skills foresights, scenarios and forecasts. Volume 2. ETF.CEDEFOP.ILO. 2016" p. 104

<sup>98</sup> The reviewed Job Strategy of the OECD also aims to focus on the current demand for skilled workforce enabling to reduce very considerable distortions in labour markets. (Ministerial Statement: Building More Resilient and Inclusive Labour Markets. OECD Labour and Employment Ministerial Meeting. Paris, 15 January 2016 (<http://www.oecd.org/employment/ministerial/labour-ministerial-statement-2016.pdf>))

<sup>99</sup> Guide to anticipating and matching skills and jobs. The role of employment service providers. Volume 4. ETF.CEDEFOP.ILO. 2015

<sup>100</sup> Report on the G7 Follow Up Meeting. Rome, 9 November 2017. 30 November 2017

### *Lack of clarity in definition of the “demand”*

The studies summarized in this Report show the problem with a definition of the “demand for skilled labour” which remains vague for practical utilization by VET systems. In the literature, the labour market *demand* is defined indirectly as an employment size and (occupational and age) structure by sector/industry/ occupation.<sup>101</sup> The expansion-related demand for skilled labour, the replacement demand and the identified shortages of skilled labour, as well as resulting occupational and qualifications mismatches – may all be interpreted as various demands for skilled workforce which need to be addressed for balancing the labour markets. It remains unclear which of those proxies should be used as signals or objectives in allocating publicly-funded VET enrolments.

### *Whether detailed occupational structures are applicable in forecasting of labour markets?*

The methodology applied by Cedefop suggests that “supply of labour force is not measured by occupations as it is not possible to attribute people to different jobs after acquiring particular qualification: the occupational decisions of individuals vary significantly and cannot be predicted. Moreover, employment in occupations will change in the life course of individuals”.<sup>102</sup> This assumption seems to deny the need for planning and funding of enrolments by occupation since graduates are generally not assumed to work in the occupations in which they had been educated and trained. The above may hold true for periods of 20 years when some people have no choices but change their occupations as long the job market is changing. However, it is undeniable that the probability of the fact that people trained as medical technicians will become aviation mechanics is very low. This puts value in acquiring a broad but definitive occupational qualification. Some rare examples have been described when forecasts were used for influencing student enrolments, however, without practical implementation. See, for instance, the discussion on Finnish experience (Section IV).

### *Planning of enrolments versus informed vocational guidance*

Some studies advise that the previous focus being placed on direct interventions to influence skilled graduates produced has now shifted towards informing labour market participants on available education and career choices.<sup>103</sup> It is therefore suggested that that VET enrolment planning is not useful and that the informed students should decide in which courses to enrol. USA and Canada do forecast future labour supply. However, they also apply their forecasts of the occupational demand for advising labour market participants to acquire certain occupations and qualifications which are expected to be employable and generate competitive wages in the future labour markets.<sup>104</sup> This market concept may to a certain extent apply in the countries offering a broad variety of training programmes entirely at the request of students. It is assumed that students are well informed in making their enrolment decisions. However, if an excessive number of applicants have been attracted by the same employment opportunities and high anticipated wages for a limited range of occupations, the public VET will have to make decisions on enrolments per occupation. The masses of students who are well-informed by the very advanced labour market information system can produce considerable mismatches in the labour markets.<sup>105</sup> In developing countries with their

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<sup>101</sup> Guide to anticipating and matching skills and jobs. Working at sectoral level. Volume 3. ETF.CEDEFOP.ILO. 2016

<sup>102</sup> Future skills supply and demand in Europe: Methodological framework. Research paper No. 25, 2012. Cedefop. Luxembourg. [http://www.Cedefop.europa.eu/EN/Files/5525\\_en.pdf](http://www.Cedefop.europa.eu/EN/Files/5525_en.pdf)

<sup>103</sup> Guide to anticipating and matching skills and jobs. Working at sectoral level. Volume 3. ETF.CEDEFOP.ILO. 2016

<sup>104</sup> The Occupational Outlook Handbook, 2016-2026, US. <http://www.bls.gov/ooh/> (Accessed on 01.03.2018)

<sup>105</sup> For instance, in Australia, a study revealed that 85% of student demand-driven VET enrolments spread across 200 qualifications and the remaining 15% spread across 1444 qualifications. This tends to produce very considerable occupational mismatches. (Payton A. Skilling for tomorrow. 26th National VET Research Conference ‘No Frills’. NCVER. 2017)

limitations of operational capacity and of public and private funding, the student-demand driven policy is unable to prevail. The public VET will have to decide which courses to offer and which enrolments to finance. It remains a tough job which requires knowledge of regional and local labour market needs. It means that the labour market analysis has a role to play in influencing the public training offer.

### *The need to shift focus from sectors to regions*

The broad literature on anticipation of labour markets focuses on economic activities (industry sectors) in producing the economic scenarios and the labour force demand and supply forecasts.<sup>106</sup> However, the sector-based approach makes it difficult for VET systems to utilize the estimates of forecasts. This is because the VET systems are organized by regions but not by sectors of the economy. Regional/ provincial VET systems are guided and financed by regional governments who have responsibility for regional labour markets. Regional VET systems enrol local residents who, having completed relatively short training, commonly seek employment in the same regions. For this reason, the analysis of economic growth and of labour markets and the related labour demand and supply, in practice, should put more focus on regions.

From the practical point of view, it is not very useful to analyse shortages of *skilled worker* occupations nation-wide since training of additional numbers of workers would not necessarily result in migration of fresh graduates to the regions with identified occupational shortage.<sup>107</sup> It is reported that many countries do produce regional labour market forecasts.<sup>108</sup> However, in the literature, the analysis of the regional labour markets and its practical implications for planning of VET enrolments is not well-described.<sup>109</sup> Forecasting of the demand for skilled labour by sector is useful mostly for sector specific occupations such as for instance, pilots and aircraft engine mechanics for the aviation industry.<sup>110</sup>

On the one hand, most of industry sectors do not have training providers belonging to them and very few training providers focus on sector-specific occupations and qualifications because those involve high delivery risks. On the other hand, individual companies may successfully partner with training institutions delivering specific occupational programs. The experience of Employment and Social Development Canada (ESDC) Programme is reported which supported partnerships between companies and training providers in a defined range of STEM programs. This means that companies are involved in assessment of their future demand and make arrangements with individual providers on the timely supply of graduates. The Programme provides wage subsidies to employers offering quality student work placements and helps recruiting students for these placements. The Program is expected to produce up to 10.000 new work placements over the next four years, in several sectors, including Biotechnology, ICT, Environment, Aviation and Aerospace.<sup>111</sup>

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<sup>106</sup> Guide to anticipating and matching skills and jobs. Working at sectoral level. Volume 3. ETF.CEDEFOP.ILO. 2016

<sup>107</sup> Barnow, B, Trutko, J & Piatak, J. (2013) Occupational Labor Shortages: Concepts, Causes, Consequences, and Cures, W.E., Upjohn Institute for Employment Research, Kalamazoo, MI.; Regions at a Glance. 2011, OECD, Paris. [http://www.oecd-ilibrary.org/urban-rural-and-regional-development/oecd-regions-at-a-glance-2011\\_reg\\_glance-2011-en](http://www.oecd-ilibrary.org/urban-rural-and-regional-development/oecd-regions-at-a-glance-2011_reg_glance-2011-en)

<sup>108</sup> Guide to anticipating and matching skills and jobs. Developing skills foresights, scenarios and forecasts. Volume 2. ETF.CEDEFOP.ILO. 2016 p.111

<sup>109</sup> Marie-Béatrice Rochard: "How to anticipate the evolution of qualifications and training needs: a regional point of view". In: Building on skills forecasts, op.cit.

<sup>110</sup> Aviation and Aerospace Industries. Labour Market Outlook. Canadian Council for Aviation & Aerospace ([https://www.avaerocouncil.ca/sites/default/files/files/05\\_ccaa\\_labour\\_market\\_information\\_report\\_2017.pdf](https://www.avaerocouncil.ca/sites/default/files/files/05_ccaa_labour_market_information_report_2017.pdf) 9 (accessed 02.03.18)

<sup>111</sup> Report on the G7 Follow Up Meeting. Rome, 9 November 2017. 30 November 2017

One of the rare examples of regional VET planning outside labour market forecasting is reported in Japan, where the areas and volumes of public VET offerings are decided through the governance arrangements involving councils with participation of workers, employers, training providers, and other stakeholders which take place nationally and in 47 prefectures. The variables involved in decision making are the number of job openings by industry and occupation, the ratio of training applicants to VET capacity, the proportion of trainees that found jobs after training, etc.<sup>112</sup>

*The use of experience of labour market analysis and forecasting by VET*

**Section IV** has reviewed the attempts made in European countries to estimate the need for future supply of skilled workforce at several ISCED qualification levels on the basis of projections of the future market demand. For instance, in Norway, it was estimated that the future demand between 2006-2030 for persons with specialisation in electronics, mechanics and machinery and in some other fields will perhaps show the strongest growth resulting in the increase of employment by nearly 65 000 persons from 2006 to 2030. This allowed to forecast that by 2030, workers trained in the fields of electronics, mechanical work and machinery may constitute the largest group of VET enrolments accounting for nearly 30%, etc. The enrolment forecast is said to have taken account of the labour force participation rates and of probability of the labour market trajectories of people as well.<sup>113</sup> The logic of this forecast is clear and the outcome can be useful. However, the question arises how the VET system can utilise this forecast within the horizon of 25 years? As long as the job openings are increasing as well as the related vacancies, the number of enrolments and graduates will continue to expand. This expansion will follow the short-term job openings rather than the forecast. The content of programs will continue changing to reflect the changing qualifications requirements. However, the VET cannot train for a future stock because its programs are short-term.

The experience of Germany involves the important approach to producing data on occupational mobility which takes account of gender, etc. and can be used for understanding of how the supply side works in specific national circumstances.<sup>114</sup> This technique is applicable to the assessment of occupational turnover which makes a considerable input to the supply side. The forecast of the supply and demand in Finland is, as elsewhere, national and industry sector-based.<sup>115</sup> Such forecasts can be used for configuring national VET supply provided that the major labour market trajectories of VET graduates by occupation and qualification are identified allowing to align the supply with the size and location of future job openings. If it is not possible, the VET capacity and enrolment decisions can only be made through monitoring of job offerings, and other labour market indicators as well as of student demand for training courses. However, all these signals appear through mismatches which countries try to reduce. It is also reported, that Estonia uses the labour market forecasts, the data on employment outcomes of graduates and inputs from ministries and social partners for making decisions on how many students to enrol in VET and adult training programmes.<sup>116</sup>

The methodological base for labour market analysis (discussed in **Sections II-III**), the experience of the Cedefop forecast for the EU and the economically developed nations (see **Section IV**) demonstrated their experience of analysis of the labour demand and supply, as well as the labour

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<sup>112</sup> Report on the G7 Follow Up Meeting. Rome, 9 November 2017. 30 November 2017

<sup>113</sup> Demand and supply of labour by education in Norway towards 2030. Linking demographic and macroeconomic models. In: Building on skills forecasts., op.cit.

<sup>114</sup> T. Maijer: "Methods and results of skills demand and supply forecasting. The case of Germany" In: Building on skills forecasts, op.cit.

<sup>115</sup> Education, training, and demand for labour in Finland by 2025. Finnish National Board of Education. 2012 (see Annexes 5-7).

<sup>116</sup> Skill needs anticipation: Systems and approaches. Analysis of stakeholder survey on skill needs assessment and anticipation. ILO. Geneva, 2017.

market mismatch indicators which can be used for estimating and monitoring needs for occupations and qualifications. However, this experience is not quite that what the VET systems need if they were to align their supply of graduates closer to the identified demand for skilled workforce. The complex experience of labour market forecasting cannot be immediately converted into a practical process for analysis of the current demand and supply of skilled workforce. Most of countries on earth are unable to produce sophisticated forecasts while many of those who had their forecasts produced have been unable to apply their results for advising the technical education and training delivery. VET systems in many countries continue navigating towards objectives which exclude parameters of the labour markets.

VET systems have been unable to fully benefit from the extensive practice of forecasting of labour markets because:

- Future scenarios are less useful for VET since its operations are mostly concerned with the current and short-term demand and supply due to the short-term nature of VET programmes;
- The format of the demand for labour is too aggregated and has been unable to include individual occupations and qualifications which are used for planning of the supply (VET enrolments)<sup>117</sup>;
- The current definition of “demand for labour” cannot be easily interpreted for guiding enrolment planning in education and training systems; the concept needs to be developed involving proxies/indicators against which VET supply can be judged as “relevant to the market demand”;
- Analysis of supply and demand for VET qualifications does not focus on *regional* populations and regional labour market needs where the VET delivery structures are located and against which the VET offerings should be planned; sectoral analysis of demand for VET qualifications is useful mostly for the sector-specific occupations;
- The reviewed forecasting scenarios are mostly economic and do not fully recognize the role of consumers in deciding on training and labour market careers what eventually determined the structure of the labour supply; the approach to combining the labour market demand-driven VET with the student-demand driven VET should be developed;

The capability of formal VET and of on-job training to flexibly respond to the demand for skilled labour is viewed as the major adjustment mechanism for reducing labour market mismatches (see **Section III.4**). However, the flexible and well-functioning VET systems can achieve little if: a) training and employment preferences of students, for whatever reason, persistently deviate from the identified market demand for skilled workforce, b) labour markets’ incentives for acquiring skilled qualifications are weak, and c) the relevant labour market information is missing.

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<sup>117</sup> On the basis of common LFS which applies very small samples, it is impossible to analyse the needs for skilled workforce by occupation and qualification. Small samples of LFS is also a problem for regional analysis of demand for skilled workforce because it can produce only scarce data.

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