Methods to Anticipate Skills Demand

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Technical Note

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Abstract

In Latin America and the Caribbean and in more advanced economies there is evidence that suggests an imbalance between the skills of the workforce and the skills demanded by the productive sector. If this skills mismatch is large and persistent it leads to significant economic and social costs: economies cannot use their human capital efficiently and many individuals cannot access good quality jobs. Correcting these imbalances is not easy; a number of frictions that are prevalent in the labor and education markets limit the capacity of households and education providers to provide skills in line with the requirements of the private sector. In light of this, governments around the world have developed tools that intend to anticipate skills demand in the labor market in order to inform the decision making of households, businesses, training providers and policy makers. A wide variety of tools have been developed, ranging from quantitative econometric models to more qualitative methods such as roundtables and focus groups. This report provides a description of the existing methodologies; an analysis of their objectives, strengths and weaknesses; and a description with illustrative examples. The report stresses the fact that an effective system to anticipate skills demand usually combines a variety of methods and surmounts challenges that are not only technical but also institutional. Systems to anticipate skills demand should not only focus on generating quality data but also on building processes to ensure that the information is effectively used in decision making.

Content

1. Introduction

In Latin America and the Caribbean (LAC) and in more advanced economies there is evidence that suggests an imbalance between the skills of the workforce and the skills demanded by the productive sector (e.g., Bassi et al 2012, Cappelli , 2014, Mourshad et al 2011, Manpower Group 2014, ILO 2014). If this skills mismatch is large and persistent, it leads to significant economic and social costs: economies cannot use their human capital efficiently, and many individuals cannot access good quality jobs.

Correcting these imbalances is not easy. Skills gaps are caused by frictions that are prevalent in labor markets. Individuals make education and employment decisions with incomplete information on the economic returns from each alternative. Moreover, wages do not always reflect the valuation that markets assign to skills and, even when they do, adjusting skills supply takes time and is costly.[3] Given the many restrictions that limit the capacity of households and education providers to respond quickly to the requirements of the private sector, governments around the world have developed tools to anticipate skills demand in the labor market. These tools are designed to construct information to guide households, businesses and training providers in their decisions to supply and demand skills. They also intend to provide information for policymakers to help design, monitor and evaluate skills development policies. Therefore, they should be used in a framework of an integrated skills identification system, which provides timely and quality data to inform decision making by policymakers, households and employers.

These tools, which encompass prospective econometric models[4] and more qualitative methods such as development of roundtables and focus groups, are frequently implemented in developed countries. In fact, their use has increased recently given the high

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[3] In first place, employers may set wages at levels that do not fully reflect their skill requirements if, for example, there are institutional constraints (e.g. minimum wage) or wages are used to stimulate productivity (e.g. wage efficiency). Add to that the fact that wages in principle may reflect current labor market conditions, which could differ greatly from future conditions.
4 Prospective relates to the future, to the set of analyses and studies on the technical, scientific, economic and/or social conditions of a future reality in order to anticipate it in the present.

unemployment levels that many countries in the developed world began to experience after the global economic crisis. In Europe, many analysts believe that a skills gap is a constraint that stands in the way of economic recovery, and have called for greater efforts to identify future skills requirements (e.g., ECB 2012, ILO 2014). Something similar happened in the United States, where there is an increased concern about the quality and relevance of the skills provided by the education system.[5] The emphasis has frequently been on the importance of anticipating demand, not only for cognitive skills but also for *soft* skills, for which there may also be a mismatch.

The importance of investing in this type of instruments has also been stressed in light of the rapid technological change, which accelerates changes in skills demand and increases the uncertainty of future skills requirements. Technological change has also facilitated the development of better instruments, through the increased availability of large databases (big data) and digital platforms that characterize the supply and demand of skills in the labor market (e.g., labor intermediation platforms, such as Linkedin or Monster).

In LAC, there are numerous initiatives to design systems to identify the gap between the demand and supply of skills. In general, these initiatives imply major challenges, some of which are **technical**: appropriate models, advanced techniques and quality data are often not available. This means that many of the diagnoses are often based on business surveys that collect general and subjective information on recruitment difficulties, and whose design and sampling is not always based on rigorous conceptual frameworks. Other challenges are **institutional**. As discussed later, anticipation of skills requirements has to be part of a comprehensive system based on the coordinated application of a range of tools and a combination of alternative sources of information using standardized processes and mechanisms. This system should provide relevant data to help the government make informed policy decisions on human capital development and, also, inform the decisions of

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[5] See Cappelli (2014) for a summary of the discussion by public policymakers and academia on the extent and severity of the skill gap in the United States. Capelli also evaluates the pieces of evidence that can be used to identify the skill gap and calls into question the quality of some of the data most frequently cited by analysts and policymakers in this discussion.

private agents (e.g. training providers and potential students). Unfortunately, this is not the case in LAC where, generally, efforts to anticipate skills demand are made in isolation, uncoordinated, and with no standardized processes. Hence, the results obtained from these efforts are not used systematically to guide policy decisions or private investments. Even though many countries have better administrative data and business surveys, this information is rarely used to identify the existence of skills gaps and support policies to close such gaps. Thus, most countries in LAC do not have a solid diagnosis to answer fundamental questions, such as if there are substantial skills mismatches, and if these mismatches are permanent or temporary, national or local, sectorial or aggregate.

The aim of this report is to contribute to the development of systems to anticipate skills demand in the region with a description of existing methodologies; an analysis of their objectives, strengths and weaknesses; and a description with illustrative examples. Section 2 describes the objectives of the methods to anticipate skills demand, and section 3 briefly lists the different approaches. Sections 4 to 7 describe in more detail each methodological approach with illustrative examples from advanced economies. Section 8 contains a brief discussion of the institutional environment in which these systems exist. Finally, section 9 concludes.

2. Why do we need to anticipate skills demand?

Efforts to anticipate skills demand began after World War II in the context of high economic growth when it was believed that governments, through education and training policies, could ensure the supply of workers required in the economy. Since then, the usefulness and quality of these efforts have been subject to debate. Some have argued that centralized planning in the labor market is unnecessary, since individuals and employers can guide their investment decisions on human capital with the signals sent by the market through wages. Others have emphasized the difficulty of predicting future labor market trends due to the prevalence of multiple and unanticipated shocks (CCL, 2007).

However, there are good reasons to justify an effort to anticipate trends in labor demand. As was discussed previously, multiple failures may limit adjustments between skills supply and demand. First, wages can be "noisy" signals of the future demand for skills. Second, both firms and individuals may fail to recognize market signals and, since adjustments in skills provision are costly and take time, changes in supply may lag changes in demand. Education and training institutions may not have the capacity to adapt to future demand at the required speed without public interventions.

Information on future skills demand is useful for individuals who plan to invest in their training and want to estimate the return on these investments. It can also inform the planning strategies **of education institutions and training centers**. Thus, this information can help reduce inefficiencies in labor and training markets and also contribute to more informed decisions by the **government**. Knowledge of future labor market trends can guide government interventions in education and training to achieve long-term economic and social objectives.

The various approaches and methodologies for anticipating skills requirements will be described in more detail in the next section. In general, these methods attempt to answer the following questions:

- In which sectors and occupations will most jobs be generated?
- What qualifications/skills will have more/less demand? How is this balanced with supply?

As will be discussed below, these methodologies are not attempting to ***predict*** demand in the labor market, but to ***anticipate trends*** that have a high probability of happening. The ultimate goal should be to generate high quality information that guides the decisions of individuals and training providers and which can result in the strategic planning of public policy. Ideally, these methodologies should not only anticipate demand for ***occupations*** but also demand for ***skills,*** to help guide human capital investments and policies. However, as will be discussed later, this is a considerable challenge even in the most advanced countries, where, in the

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most cases, available information only provides estimates of demand for occupations or qualifications, which are then used as proxy measures for skills demand.

3. What approaches exist?

The methodologies to anticipate future skills demand range from more quantitative methods, such as econometric models, to the more qualitative, such as sectorial roundtables and focus groups. The trend in most countries is toward the use of mixed methods that combine both qualitative and quantitative elements. For example, in countries like Germany, the United Kingdom, Austria and the Netherlands, quantitative models are one of the many pieces of information used to build a more coherent and detailed picture (CEDEFOP, 2008). Table 1 summarizes these methodologies and Appendix 1 lists the links to web pages.

Each of these methods has advantages and disadvantages. For example, quantitative models are usually the most consistent and comprehensive. However, they have high data requirements and the information they produce may be too general to guide training decisions. In contrast, qualitative methods used in sectorial studies have the virtue of providing more detailed information and promoting the coordination between the private sector, the government and training providers .Thus, these exercises not only generate information on future demand but also create spaces that encourage stakeholders (public sector, productive sector, technology specialists and training providers) to meet and discuss the training policies required.

Business surveys and systems to monitor administrative data are usually easier to manage and interpret. However, they usually produce cyclical or very short-term information. In this respect, they are less effective for *anticipating* future demand than other tools.

The tools also have advantages and disadvantages depending on their target public and their objectives. The *AMS-Skills Barometer*, for example, is a public platform that publishes information on skills requirements and occupational profiles for young job seekers in Austria.

Other tools, such as the skills councils in UK, are mainly aimed at generating information to guide government decisions.

In most cases, these models only estimate the demand for occupations and not the demand for *qualifications* or *skills*. This is largely due to the difficulty of systematizing information on occupation requirements, which can be highly complex since different skills can often be used for the same occupation. For example, anticipating the demand of skills in the Information Technology sector is complicated by the fact that computer programmer positions are often filled by individuals who do not have an undergraduate degree in Computer Science (Capelli, 2014). Thus, in addition to the challenge of anticipating changes in occupational requirements, these systems face a challenge that is perhaps even greater: anticipating the skills demand for each occupation.

Table 1. Methods to anticipate skills demand

Approach	Advantages	Disadvantages	Examples
Formal quantitative models for forecasting demand (econometric, general equilibrium or time series extrapolation)	• Comprehensive (typically include all sectors) • Consistent • Short and long term • Assumptions are explicit and transparent	• High data requirements • Quality depends on availability of data and on assumptions. However, they can give a false impression of accuracy • Results may be too general to guide training decisions	-Europe: Projections by CEDEFOP /University of Warwick - UK: Working Futures - University of Warwick projections -Canada: Canadian Occupational Projection System
Employer surveys on skills requirements	• Direct involvement of private sector • Easy to administer and interpret	• There may be inconsistencies across sectors • Subjectivity in responses • Reliable only in the short-term	-UK Commission of Employers Skills Survey -Pilot survey of skills needs in the EU- CEDEFOP
Monitoring systems of administrative information on public or private sector vacancies	• Easy to administer and interpret • Use existing administrative data	• Short-term focus • There may be inconsistencies across sectors	Austria: AMS-Skills Barometer New Zealand: Job Vacancy monitoring program

| Sectorial/regional studies and observatories (in addition to quantitative component, they usually have a qualitative component, such as focus groups, roundtables, Delphi methods) | • Private sector involvement
• Detailed information on sector and specificities
• Factors other than economic development can be integrated into analysis | • Partial analysis - focuses on a single sector and on demand for direct (not indirect) jobs
• There may be inconsistencies across sectors
• Not systematic
• Qualitative evidence may be subject to subjectivity and inconsistency and assumptions are not explicit | -Sectorial studies European Commission

- Sector Skills Councils and Local Enterprise Partnerships -UK

-Industry Training Organizations New Zealand |

Source: Authors' adaptation and extension of Wilson and Zukersteinova (2011)

Thus, even in the case of the most rigorous quantitative models, it is not easy to predict future skills needs with a high degree of accuracy. In general, these systems are only able to provide participants in the labor market and governments with information to prepare for future events that are *likely.* Each of the four methods listed in Table 1 is described in greater detail below with examples.

4. Quantitative models

In general, developed countries use quantitative models to forecast future labor demand. These models are usually based on forecasts of aggregate economic activity, demographic projections and other relevant indicators such as wages. From this information, forecasts of labor demand at the sector level are estimated. These estimates of sectorial labor demand and data from labor surveys are then used as inputs to generate forecasts of labor demand disaggregated by occupation.

In most European countries, figures of labor supply by education/qualification level are also projected, even though these data often have a lower level of accuracy. The main parameter usually estimated is the flow of people leaving the education system and entering the workforce by education/qualification level. In some cases, this parameter is supplemented with estimates of the short-term unemployed who are ready to take a job (CEDEFOP, 2008). The comparison between supply and demand projections can, in principle, be used to identify gaps in occupations/qualifications.

These models are an essential starting point for any comprehensive analysis attempting to estimate skills needs. Their main advantage is that their assumptions are explicit and transparent. In addition, they can guide the discussion on skills gaps by means of rigorous and consistent evidence. In many cases they can also be used to build counterfactual scenarios to analyze the impact of policy interventions.

Given that their main objective is to make forecasts from macro evidence, these models do not have a fine level of detail. Therefore, these models will not generate detailed data on education and training requirements to inform training policies. These models are not akin to "crystal balls" that predict accurately the future. Their aim, rather, is to identify general trends that have a high probability of happening and warn of possible future imbalances (CEDEFOP, 2012).

A major challenge in the estimation of these models is the anticipation of future technological changes that may alter employment requirements. There is also the difficulty of forecasting individual occupational trajectories (CEDEFOP, 2008). Finally, since individuals in a particular occupation may have very different qualifications, projecting qualifications/skills needs based on occupations is very difficult.

4.1 Example: European Union model for forecasting skills demand and supply (CEDEFOP)

The European Union forecasting system for skills demand and supply was recently developed by CEDEFOP, the EU agency responsible for development of technical and vocational training. Since 2008, this system has generated forecasts of skills demand and supply for the European Union (EU) and each member country. The model also produces forecasts by economic

sector (42 sectors), occupational group and education level. Its design is largely based on *Working Futures,* the leading projection model of the labor market in the United Kingdom.[6] The framework of the system is illustrated in Figure 1. The system has a series of modules or components, which can be adapted to develop alternative scenarios. The first module is a macroeconomic model of sectorial activity, which mainly uses national accounts data from member countries as inputs. This model produces **labor demand projections for 42 economic sectors.**

Module 2 uses the aggregate projections produced by the first module to construct **projections of labor demand by occupation**. The inputs used are workforce surveys conducted in all European countries, from which data on employment by sector and occupation is obtained. Module 3 follows a process analogous to module 2 to generate **demand projections by qualification.** This information is particularly important for training policies. However, due to data limitations, it can only be disaggregated into three broad categories (low, medium and high, using the UNESCO ISCED classification).

Module 4 estimates **replacement demand,** that is, labor demand generated by individuals leaving the workforce (migration, age retirement, etc.). Ideally, these projections are generated with information on flows of individuals who leave the workforce and inter-occupational mobility rates. This information is available at country level but not at European Community level. Hence, for estimates at European level, only information on labor supply by age cohort is used.

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[6] Warwick University has been commissioned to develop the technical design of both *Working Futures* and the CEDEFOP model.

Figure 1. CEDEFOP model of skills imbalance forecast [7]

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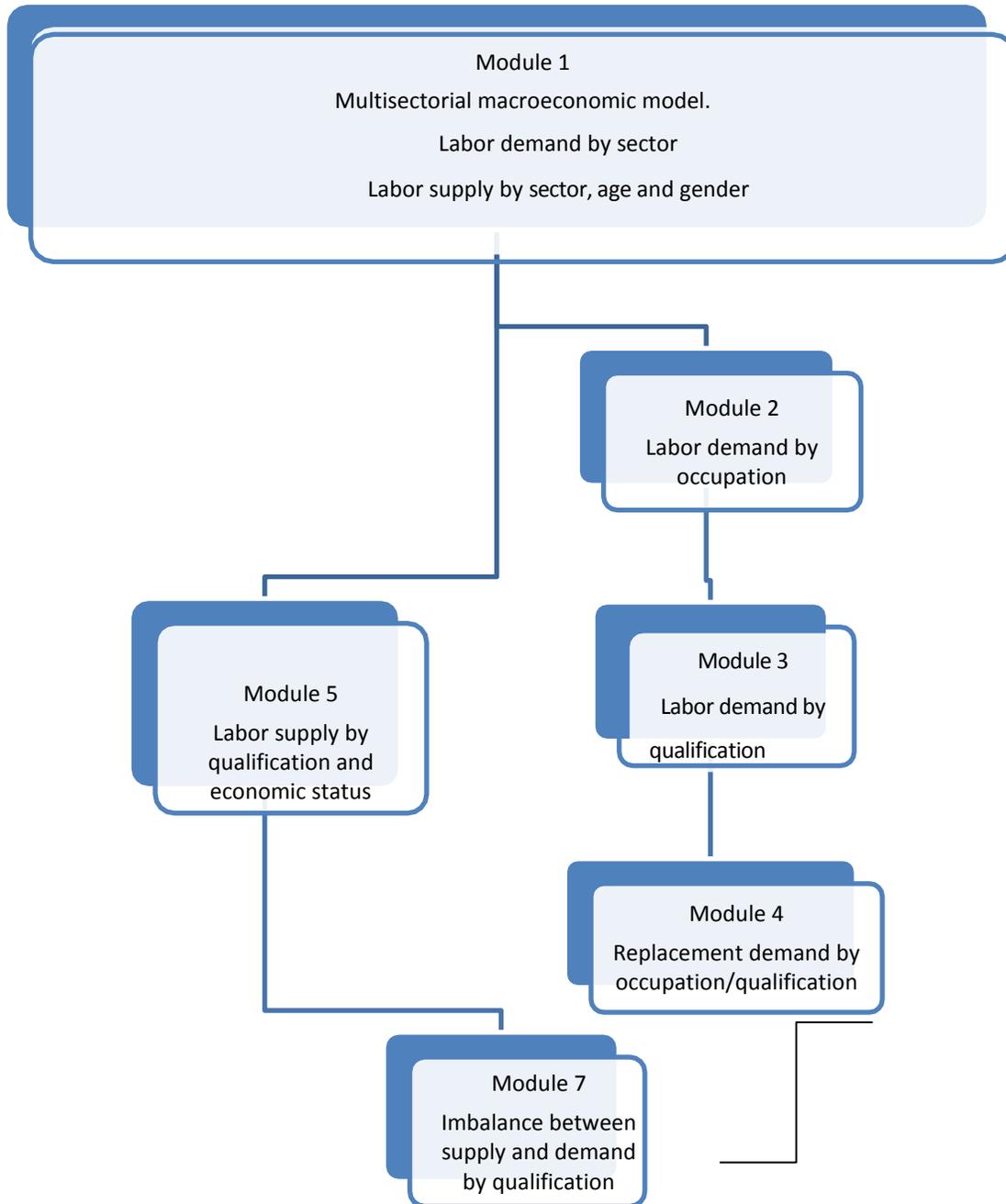
[7] The system included a module 6 to project the flow of individuals in each occupation level based on administrative data. This module is no longer used due to the poor quality of the information

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Finally, module 7 projects the imbalance between supply and demand by qualification. This is a challenging task, since many jobs can be filled by individuals whose qualifications are non-traditional. This module distributes the aggregate labor supply to each qualification by assuming employment levels by qualification as well as labor force participation by qualification.

Projections of **aggregate labor supply** are obtained from module 1 using data on economic activity, wages and benefits. Supply projections are generated by country, age group and gender. These data are then used to model participation and educational attainment in Module 5, and to project education supply for three different education levels using the UNESCO ISCED classification. Based on this model, predictions of supply and demand imbalances are then made at the qualification or education level.

4.2   Example: Canadian Occupational Projection System.

Canada has a tradition of labor market projections dating from the 1960s. It is currently implementing the *Canadian Occupational Projection System (COPS),* a model developed by the *Department of Employment and Social Development Canada (ESDC),* fed by a system of information from the federal government, provincial governments, researchers and analysts. ***Unlike the CEDEFOP model, COPS only projects imbalances in the supply and demand for occupations, without measuring skills mismatches.***

Originally, COPS only measured demand for occupations but, since the 1990s, supply projections have been integrated, so that imbalances between supply and demand can be estimated. In total, the system produces projections of 238 occupations covering the entire workforce. The results are published on the ESDC Canada website for use by job seekers and employers, *jobbank.gc.ca.*

Broadly speaking, the COPS methodology resembles that implemented by the Bureau of Labor Statistics to estimate employment requirements in the United States and that used by

CEDEFOP for Europe, described above. The general principles are the same. First, a macroeconomic model is estimated which produces long-term economic growth projections. These projections are used to estimate levels of **labor demand by occupation**. In addition, **replacement demand** is estimated for each occupation (to assess the need for new workers due to job rotation, age retirement, etc.). **Labor supply for each occupation** is estimated from information on graduates from the education sector, immigrants and new entrants to the workforce. Finally, estimates of imbalances between supply and demand are used to identify occupations where there is shortage/surplus of demand.

Like most quantitative labor demand projection models, including the one by CEDEFOP, the COPS is limited by the difficulty of anticipating technological change. Moreover to the extent that it estimates occupation imbalances, it is not easy to translate the results into measures of skills mismatches to provide input for training and education policies.

5. Employer surveys on current or short-term skills requirements

Most developed countries conduct some sort of survey of employers to identify **current or short-term** demand for skills or training. These surveys are generally aimed at identifying skills needs to: i) design training programs, ii) design life-long training policies and/or iii) identify gaps in jobs or skills, recruitment problems, or difficulties in human resources management. They are rarely used to anticipate skills demand in the long term due to lack of information and consistency in anticipating future shocks by employers. However, they are useful for estimating skills requirements in the short or medium term. Thus, it is important to regard business surveys as one piece of an integrated system which, based on a variety of inputs, aims to identify skills demand of the economy.

Employer surveys often provide information on employer demand in terms of jobs. A common approach is to collect information on vacancies (by occupation and/or qualifications), hiring, recruiting difficulties and the causes underlying these difficulties. This is

the case, for example, of both the *IAB Stellenerhebung Vacancy Survey* of Germany and the *Employer Skills Survey* of the United Kingdom, which are described later.

In some cases, there is also an effort to describe the skills required for each job (e.g. teamwork, communication skills, etc.) to provide a skills profile for each job or occupation. An example of this type of initiative is the CEDEFOP employer survey on skills needs, to be discussed in more detail later. However, in practice, it is more common to obtain information on jobs skills requirements from employees' surveys (as opposed to surveys for employers). Some examples of these initiatives are the PIAAC and the United Kingdom *Skills in Employment Survey* and *Occupational Requirements Survey,* which collect information from employees on their job requirements, such as vocational and educational preparation, cognitive, mental and physical demands.

Firm surveys that collect information on skills requirements often collect data on wages, which is clearly essential to understand skills demand. These surveys also provide information on institutional constraints that can lead to imbalances in skills supply and demand, such as the existence of collective bargaining agreements. However, since wage information provided by employers can be inaccurate, it is advisable to find ways to crosscheck information from the survey with more reliable administrative records. It is also worth noting that the analytical value of these surveys increases significantly when performed repeatedly, since one can answer fundamental questions, such as whether the imbalances are temporary or permanent. Thus, it is important to design surveys based on rigorous conceptual frameworks.

5.1   Example: The National Employer Skills Survey (UKCES)

This survey, conducted at two-year intervals by phone, was implemented for the first time in 2011. However, the current version is based on a previous employer surveys to identify skills gaps, which had been conducted in the United Kingdom since the late 1980s. Its purpose is to collect information on skills requirements in the workplace, companies' training strategies

and vacancies that are difficult to fill. It has an extensive coverage, with data collected on 96,000 establishments with one or more employees in its latest round.

Information collected includes the general attributes and business structure of the company, hiring practices, demand for skills, obstacles for meeting skills requirements, and training and development of the workforce. Questions on recruiting focus on the hiring of young employees in entry level positions. There are also questions about *High Performance Working- HPW* practices*,* which relate to practices of human resource management designed to motivate staff and increase their degree of involvement and commitment. Questions are also included on marketing strategies, product development, innovation and economic performance (sales, profits).

The survey identifies two types of skills gaps. First, gaps in the skills of employees who are already part of the firm *(internal skills gap)* and, second, skills shortages in the labor market *(external skills shortage).* The former are obtained from questions that evaluate the level of competence of existing employees. The second is calculated from questions on the existence of vacancies that are difficult to fill for each type of occupation.

In addition, the survey generates information on what would be a *latent skills gap* which, instead of comparing skills supply with the firms´ demand, makes the comparison with respect to a theoretically optimal level of demand (i.e, "latent demand"). This method acknowledges the fact that some firms may demand low skills levels because of their low level of productivity and competitiveness. This optimal level of demand is constructed from information on the firms' performance (e.g. market position, financial situation), and comparisons with respect to the rest of the industry.

Lastly, it is worth mentioning that this survey also collects information on the skills requirements of each occupation. Information on skills requirements is collected for both general skills and specific technical skills[8] at the occupational groups level in each

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[8] Computer literacy (basic level), advanced level IT or software, communication skills (oral and written), language, customers interaction skills, teamwork, problem-solving skills, planning and organization, strategic management, numeracy skills, literacy skills, technical, practical or skills specific to the job, among others.

establishment, and is used to construct representative measures of skills requirements at occupation level.

5.2   Example: Pilot survey on skills needs in the European Union - CEDEFOP

The European Union commissioned CEDEFOP in 2011 to develop a survey of skills needs in member countries, whose design is currently underway. In 2013, a pilot for the three most important occupations was conducted in seven economic sectors in nine member countries. The frequency of the survey is still under discussion.

This pilot was an innovative initiative designed to identify requirements of skills, competencies and qualifications in jobs from the employer perspective. Information was collected on generic competencies common to many jobs (e.g., ICT, math, language) and specific competencies. It also identified whether or not these competencies would play a substantial role in the job.

To achieve this objective, the survey design was based on the following structure:

- Module 1: Collect information on the firm's general attributes and identify an occupational reference group.
- Module 2: Collect information on a series of generic tasks for the occupational reference group. These generic tasks can be applied to many types of job or occupation. Collect information on: i) the importance of these tasks in the occupational reference group; ii) the change in importance and iii) employees' level of preparation for these tasks.
- Module 3: Collect information on the importance and development of a series of occupation-specific tasks or skills associated with the occupational reference group. Information is also collected on: i) the importance of these tasks, in the occupational reference group; ii) the change in importance and iii) employees' level of preparation for these tasks.
- Module 4: Collect information on possible technological or organizational changes and

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their impact on the occupational group reference.

The *tasks* were defined so as to identify the use of skills. Thus, *generic tasks* capture the use of *generic skills* and *specific tasks* capture the use of *specific skills.* Examples of generic tasks include: *making presentations, persuading, giving instructions*; identifying these tasks captures the use of *communication skills*. The focus of the questionnaire on *tasks* rather than on *skills* is due to the fact that employers may identify more easily the tasks associated with an occupation rather than the skills.

Given that the ultimate objective of the survey is to provide inputs for designing work training policies, the organization of the questionnaire around occupational groups may be an advantage, to the extent that technical and vocational training systems in Europe are often designed in terms of occupations and not sectors. This, however, creates a challenge for the design of the sample, because firm registrations usually identify the economic sector and not the occupations, thereby increasing the difficulty of building a representative sample at the occupation level. To solve this problem, the survey identified sectors with a significant concentration of occupations of interest.[9]

The CEDEFOP survey also collects information on on-the-job training and the diversity of contexts in which companies invest in human capital. Specifically, data is collected on: i) formal training, defined as structured provision of training in classrooms or firms; ii) informal training, defined as skills acquisition by participating in activities in the workplace in which knowledge is imparted; and iii) non-formal training, consisting of skills acquisition from the simple exercise of regular activities in the workplace.

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[9] For more details, see CEDEFOP (2008)

6. Systems to monitor information on vacancies

In some countries, like New Zealand and Austria, observatories have been set up to monitor information on vacancies in both the Public Employment Service and private employment agencies. This information is often combined with other data sources such as business surveys. The result is identification of occupations/skills that have greater demand in the market and of indicators or measures of shortages. Although the results of these exercises are of general interest, they are typically intended for a specific public.

Two initiatives are described below which differ in their objectives and orientation. The first is the New Zealand *Job Vacancy Monitoring Program* (JVMP) which, in addition to informing the public and private sector of possible skills shortages, is an essential input for the country's immigration policy. In New Zealand, the immigration system aims to attract individuals with the skills and competencies that the country lacks. The second is Austria's *AMS-Barometer,* which supplies information on the situation in the labor market for individuals who want to invest in training.

6.1 Example: New Zealand - Job Vacancy Monitoring Program

The JVMP is administered by the Department of Labour, which produces a series of indicators to identify the presence of skills shortages in the country. The JVMP has two components. First, the *Job Vacancy Monitor* consists of a **monthly** analysis of vacancy announcements reported in newspapers and on some Internet platforms. Second, the *Survey of Employers who have Recently Advertised* (SERA) covers employers that have recently published vacancies, and has two versions. The first, known as *SERA Extensive*, consists of a short telephone survey of a large number of employers to identify available vacancies, filled vacancies and applicants' suitability. The second, *SERA Intensive*, consists of an in-depth survey of a small number of employers that have posted vacancies in occupations with shortages, in order to improve understanding of the forces contributing to the situation.

From these inputs, the JVMP constructs two main indicators. First, the **fill rates** which measure the proportion of vacancies included in the SERA sample filled with a suitably qualified candidate. These rates are calculated for a limited number of occupations. Second, the **vacancy count** is simply the absolute number of vacancies obtained from the Job Vacancy Monitor. The vacancy count for a particular occupation compared with the number of unemployed is a measure of labor market tightness in a particular occupation. A comparison with the number of jobs in a particular occupation gives an idea of the relative importance of the number of vacancies.

These indicators are used to warn of possible skills gaps to guide the country's migration policies. It is possible, for example, to identify very scarce skills which can be supplied in the short term by facilitating the flow of skilled immigrants.

6.2   Example: Austria -AMS Skills Barometer

The AMS Skills Barometer (Austria's Target Group Oriented Labor Market Information System) is an instrument that provides a broad set of users with information through the internet on current and short-term demand for qualifications. The tool was created to use, consolidate and publish information already available, targeted at a broad public including: i) government; ii) companies; iii) employees, job seekers and individuals interested in investing in education or training; iv) educators, training providers, employment service counselors; and v) journalists and researchers.

The information is collected from multiple sources: i) analysis of job advertisements commissioned by AMS; ii) vacancies in the public employment service; iii) official labor market statistics; iii) regional and national forecasts and studies of skills demand; iv) business survey of occupational developments; iv) interviews with experts and v) other relevant studies. These data are processed to construct information on skills demand and future labor market trends, which is then presented in a user-friendly format. The information is updated twice a year.

The AMS-Skills Barometer is therefore not an instrument to collect new information, but a tool that compiles, critically evaluates, edits and publishes existing information. The barometer offers information on trends in the demand and wages of individual occupations as well as results of skills projections.

The information is presented at various levels of disaggregation. The first consists of 24 occupational areas, subdivided into 95 occupational fields and further divided into positions or jobs. The information on skills is also divided into hierarchical levels: 23 skills areas are subdivided into 230 skills consisting of approximately 8,000 detailed skills. For each occupational field, charts illustrating trends are presented along with information in text form on the employment situation. There is also comparative information by gender, along with tables relating qualifications to occupations; for example, qualifications and skills relevant to the "Programming and software technology" occupational field are evaluated for future relevance.

Although this instrument has wide appeal, it is still under development. Doubts have been raised about whether it is possible to cater satisfactorily to widely different audiences (e.g. experts and the general public). The creation of two separate platforms that discriminate in line with the degree of specialization and interests of users has therefore been considered.[10]

7. Sectorial studies

Many developed countries are making efforts to anticipate skills needs at the sector level. These initiatives are usually characterized by active involvement of employers. Some countries, such as Germany, have a long tradition of businesses being actively involved in anticipating future skills needs. Others, like the United Kingdom, have placed a greater emphasis on creating institutional structures to ensure the involvement of the private sector,

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[10] For more details, see Humpl and Kargl (2008).

such as *Skills Councils.* Countries like France, in contrast, have developed "regional observatories" focusing mainly on the needs of employers by region (CEDEFOP, 2008).

In spite of their diversity, all of these efforts have four characteristics in common. First, as mentioned earlier, they actively involve the private sector. Second, they only capture demand at the skill level, not at the aggregate level. Third, they focus on trends in the generation of **direct jobs** in the sector, leaving out of the analysis the **indirect jobs** along the production chain that may be created by the growth of a particular industry. For example, growth in the automotive sector is associated with direct employment in the automobiles production and assembly. However, indirect jobs are also created in the marketing and distribution of automobiles and in auto-part production. In general, analysis of the demand for these indirect jobs is outside the scope of these studies. This weakness can be more costly in the case of manufacturing sectors whose value chains are usually longer than in the service sector (Oxford Research, 2010).

Lastly, sectorial studies are characterized by combining both quantitative and qualitative methodologies. Quantitative methodologies include economic projection models and demand surveys such as those described in the previous sections of this document. Qualitative methods include, for example, Delphi analysis (see Box 1), focus groups and roundtables. Two examples of sectorial studies of skills requirements are given below.

Box 1. Delphi methods

Delphi methods are normally used in qualitative studies. They usually incorporate the progressive application of questionnaires to a panel of experts to obtain their opinions and views on a particular issue. In the focus groups, a discussion is organized on a topic of interest, possibly using material distributed beforehand and usually structured by a facilitator. Thus, it is a prospective technique for obtaining essentially qualitative, but relatively accurate, information on the future. For more detail on other qualitative methods for anticipating skill demand see Wilson (2008)

7.1   Example: Sectorial studies on needs in 19 sectors - European Commission

As one of many measures to mitigate the effects of the economic crisis, the European Commission contracted in 2008 and 2009 a series of sectorial studies on skills needs. A group of universities and research centers was commissioned to analyze 19 economic sectors using a comparable methodology. The study included manufacturing (e.g., automotive, chemical and pharmaceutical industry, textiles) and services (e.g. hotel, restaurant and catering and financial services). The following inputs were used:

- Review of existing studies, analyses and statistical publications

- Interviews with experts from universities, civil society and other relevant international organizations (Delphi methods)

- Labor statistics, mainly from the European Labor Force Survey

- Finally, roundtables and panels of leading experts in the relevant sectors, representing companies, education institutions and analysts.

A distinctive methodological feature to note is that these studies started with the identification of the *agents of change* that can alter growth patterns in the sector (e.g. technological or demand shocks, regulatory changes). Based on these agents of change, the

studies looked at different scenarios and analyzed their possible implications for skills requirements. Specifically, the method involved the following steps[11]:

1. Analysis of the main economic and employment trends in the sector.

   - Examination of historical growth trends and changes in employment levels and composition. For example, analysis of changes in occupations, education level and demographic changes.

2. Identification of the key agents of change in the sector.

   - Agents of economic change (e.g. macroeconomic growth, competition from emerging economies, emergence of new markets ...), social and political (e.g. regulation, demographic, market segmentation ...) and technical and natural (e.g. digitization, R&D, energy prices).

3. Identification of trends in occupations, job profiles, skills and competencies.

   - To illustrate with an example, several of the sectorial studies identified a trend toward *polarization* of skills needs. This phenomenon is particularly significant in service sectors, such as transport and distribution and trade. Polarization occurs when demand for highly skilled workers increases, along with demand for low skilled workers for manual work in situ (cannot be contracted to workers in emerging countries).

4. Based on the agents of change, building of possible scenarios at sectorial level and identification of their implications for generation of employment.

   - Building alternative scenarios based on the agents of change identified above such as regulatory changes, on consumer preferences, or on technology etc. For example, in the commercial sector, building scenarios that assume possible technological changes that lead to massive expansion (or not) of consumption through electronic commerce.

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[11] Taken from Oxford Research (2010)

5. Analysis of the implications of different scenarios for occupational profiles and competencies.

- To continue the example, the possible implications for labor demand in the commercial sector of massive expansion of electronic commerce would be examined. These could lead to an increase in the demand for professional specialists in electronic commerce, such as programmers and web page designers, and specialists in logistics and distribution.

- Identification of occupational requirements which are used to identify **emerging competencies** with anticipation of growing demand. These skills can be socio-emotional, technical or managerial. For example, the results of the studies may show a growing tendency to require managerial skills such as the ability to **manage international value chains,** and technical skills such as **expertise in environmental technologies**.

- The studies also identify emerging competencies at occupation and sector levels to identify whether:
  i. The skills demanded are available in multiple sectors and occupations
  ii. The skills that have traditionally been required in certain occupations are now required in others.

6. Identification of implications for training and education.

- Once employment requirements have been identified, strategies to meet these requirements are examined, considering options such as retraining existing workers, outsourcing, and recruiting young people for on-the-job training, etc., resulting in policy recommendations.

7. Presentation of recommendations and proposals for reform.

These studies produce general recommendations on industrial policy and specific recommendations on skills development policies. The first group recommends, for example, that the textile sector focus on knowledge-intensive value-added activities and technology in

order to compete with emerging Asian countries. The second segment includes, for example, strengthening learning programs and making the education system more responsive.

A weakness of the methodology applied in these studies is that, as in the case of qualitative analyses, it incorporates elements of subjective judgment. Hence, many analysts consider that a good part of the value of this type of methodology is in the process itself rather than in the technical rigor of the final result. Specifically, they value the fact that the process of scenario development requires the active involvement of employers, who are the beneficiaries of the policies, which has substantial benefits for the design of skills training policies (Wilson, 2008).

7.2   Example: Skills councils in the United Kingdom

In the United Kingdom, the Sector Skills Councils (SSC) are independent organizations led by the private sector. The councils intend to provide inputs for public policies by representing the employers' interests. They also actively design and implement private strategies to identify and meet skills needs in the sector. Their work is based on an analysis of sectorial skills requirements, which draws on a range of inputs listed below:

1. First, there are the traditional quantitative techniques used to forecast skills requirements, particularly the **Working Futures** projections, funded by the government. Unlike in the United States, in the United Kingdom these projections are not made by the government itself, but are outsourced to external researchers. This has the advantage of reducing the political costs that can come from sensitive results. In addition, competition among the organizations that bid for these projections has contributed to reducing costs and improving quality. Most of the time, since the 1970s, the University of Warwick, in collaboration with Cambridge Economics, has been the body selected to prepare the projections.

2. In addition to Working Futures, there are other projection models with regional and sectorial focus. The **regional projections** include models developed in Scotland, Wales

and Northern Ireland. There are also **sectorial projections** which are usually developed by some of the SSCs with longest tradition and institutional capacity. An example is the construction SSC, Construction Skills, which has well-established quantitative demand projection models (Wilson, 2008).

3. **Employer surveys** are another important input. Many SSCs use the information from the UKCES, described in greater detail in a previous section. However, many SSCs conduct their own surveys (Wilson, 2008).

4. Delphi methods are also developed for consultations with experts and other actors.

5. Finally, **scenarios** are constructed with employer representatives in the sector using qualitative methods similar to those described earlier in the European case.

The SSC scheme has diverse strengths. First, the private sector is heavily involved. Second, the scheme taps a variety of sources of information from quantitative methods to qualitative information from employers and experts. In addition, each SSC processes the results of the analysis in the same way to facilitate dialogue with training providers. Lastly, besides providing information to anticipate skills demand, the UK sectorial analyses are used to develop occupational standards and qualifications. Thus, the process of identifying skills requirements is one more instance of an integrated system of training at a sector level. To illustrate this point, Box 2 describes the operation of the construction SSC in more detail.

However, there is significant heterogeneity in effectiveness of SSCs and, in particular, their ability to represent the needs of firms in each sector. This has led the British government to review the financing and incentive schemes on which the SSCs operate. For example, in recent years the funding of the SSCs has shifted from public to private. This issue is discussed in more detail in the next section.

Box 2: The construction sector in England: the case of *Construction Skills*

Construction activity has a strong cyclical component. This means that it is crucial for the sector to have a skilled workforce that can respond to sectorial demand in times of economic prosperity and, at the same time, preserve the necessary skills in times of slower growth. Some characteristics of the sector make meeting this challenge more difficult. The construction sector in England is characterized by a majority of small businesses (93%), a workforce with a large proportion of manual workers (55%) and one third self-employed workers who migrate from one job to another. With this large itinerant workforce, the benefits for companies of investing in training are generally low and retention of skilled workers is relatively problematic.

The construction sector skills council "Construction Skills" has the objective of building a skills system that is responsive to demand. The council is financed by a payroll tax on employers. Micro and small enterprises with revenue below a certain amount are exempt but qualify as beneficiaries of funds for training and advice. In contrast, companies that mainly use subcontracted workers pay a higher contribution.

The tax revenue is used for:
1. Identification of the skills needed by the workforce
   - Macroeconomic analysis to identify the drivers of productivity and competitiveness
   - Labor Market Intelligence (LMI) Reports: models that analyze national productivity data to predict future skill requirements in productivity and employment
   - Analysis of "what if" scenarios

2. Definition of occupational standards in the industry
   - "Skills cards" Skill certification system for construction, in line with increasing pressure to recognize and accredit previous experience. The Skill cards are required as proof of occupational competence by contractors and public and private companies.

3. Provision of training
   - In classroom and on-the-job
   - National Skills Construction College
   - Training in management, health and safety, sustainability, plant operations, construction, civil engineering, among others

Cuddy, N. (2012), mimeo IDB

8. Institutions for anticipating skills demand at the national level

As discussed in the previous section, the process of anticipating skills demand usually takes place in complex institutional settings with the active participation of both public and private sectors. In some countries, the role of collecting labor market information is the responsibility of public agencies at ministerial level. This is the case, for example, of agencies such as the Department of Employment in Canada, the Bureau of Labor Statistics in the United States, and the Federal Institute for Vocational Education and Training (BIBB its acronym in German) in Germany.

Other countries, however, have chosen to give the main responsibility for anticipating aggregate skills demand to mixed institutions which, although publicly funded, are industry-led. This is the case of the UK Commission for Employment and Skills (UKCES), the Expert Group on Future Skills Needs in Ireland (EGFSN,) and the Workforce and Productivity Agency (AWPA) in Australia.[12]

This second group of agencies is an interesting example of an institutional design that facilitates public and private collaboration. Although the UKCES, EGFSN and AWPA have important differences, they have common features that should be highlighted. The first one is their objective: in general their mission is to give independent advice to the government on policies to address current and future skills needs. To do this, they lead the development of projection models, surveys or sectorial studies on skills demand to inform skills development strategies. The second common feature is that they are all led by representatives of the productive sector. UKCES, for example, is led by executives from both large and small firms, union representatives and employment consultants. The AWPA board has representatives of the private sector, training institutions and labor unions. For example, the current director of

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[12] The AWPA was set up in 2008 under the name *Skills Australia.* In 2012 the Australian government expanded its functions and changed its name to Australian Workforce and Productivity Agency.

the board was CEO of IBM Australia and New Zealand. The case of EGFSN in New Zealand is similar and discussed in more detail in Box 3.

Many countries also have business councils or roundtables to identify skills demand at the sector level. An example is the United Kingdom's Sector Skills Councils, which collect information on the skills needs of employers in their sector strategies. Other countries have similar organizations, such as the Industry Training Organizations of New Zealand and the Industry Skills Councils of Australia. In addition to collecting information on skills demand, these organizations also play an important role in defining occupational standards. Their financing schemes vary. Until recently, the UK Skills Councils were financed by the public sector on a regular basis. They are now financed by private resources and compete with other organizations for public financing to develop occupational standards and support training programs. This change in funding sources intends to improve skills councils' accountability to firms in the sector. The ISCs of Australia, in contrast, are financed mainly from public funds. In general, these organizations play a very important role in representing sectorial interests in the design of skills development policies, although there is a risk of over-representing the interests of the more dominant firms.

Sector skills Councils often complement the initiatives of regional business organizations that identify local and regional demand. This is the case of the Local Enterprise Partnerships (LEPS) of the United Kingdom (Feldstein, 2015). In the case of Germany, chambers of industry and commerce monitor regional demand (Länder) and project skills shortages or surpluses even as far ahead as 2025 (Fazekas and Field 2013).

Box 3: Expert Group on Future Skills Needs in Ireland

The Expert Group on Future Skills Needs advises the Irish government on the present and future skills needs of the economy, as well as on labor market issues that have an impact on businesses and employment. The tripartite body has representatives of education institutions, government agencies and the business world.

The Group is responsible for producing data on the stock of skills in the economy with the ultimate goal of focusing on training interventions with high returns, and achieving effective training policies. These data are published in regular reports, accessible to the public, which cover the following topics:

- TRENDS IN EDUCATION AND TRAINING. Panorama of skill supply coming from formal education and training. Trends in higher education, destination of graduates, profile of adult workers who receive training.

- DEMAND FOR SKILLS. Examination of sectorial employment trends, skill shortages, migration movements.

- FACTORS AFFECTING SKILL DEMAND AND SUPPLY.

- STOCK OF SKILLS IN SECTORS CONSIDERED STRATEGIC, OR WITH RAPID GROWTH. The Information Technology and Communication industry is a clear example of specific public actions to promote skills considered critical for the economy

Thus, the process of skills needs identification can operate within a complex institutional environment. A good example is the case of the United Kingdom, where the institutional framework has changed radically since its inception in the 1940s. The responsible entities have been subject to frequent changes; the latest one being the creation of UKCES, which in 2008 replaced the Sector Skills Development Agency as the umbrella organization for skills development policy. Although these institutions are in a continuous process of renewal, the United Kingdom stands out in terms of its capacity to generate comprehensive, detailed and systematic information on skills demand (Feldstein, 2015). Box 4 provides further details.

Finally, the role of KEIS, the Employment Information Service of Korea, is worth mentioning. This institution, under the Ministry of Labor, leads research and projections on trends in the country's labor market. A remarkable fact is that much of its analyses are based on the administrative information operated and managed by the service itself; in particular, the database on Employment Insurance benefits, the vacancies databases (WorkNet) and the training database (HR-Net). With these inputs, and the employer surveys which KEIS also manages, the agency produces projection models, analysis of job and skills gaps, and information on careers to guide students. The service also evaluates employment programs and policies. Thus, KEIS is a government institution with a strong technical bias that not only manages administrative databases but also evaluates programs, analyzes the performance of the labor market and anticipates future skills demands.

Box 4. Institutional structure in the United Kingdom

The United Kingdom has multiple sources of information on the labor market, comparable over time and across sectors and regions. This information is used to formulate policies for skill development. Figures are also produced to guide the decisions of employers and individuals, such as career choice (Feldstein, 2015). A good part of these efforts are led by the UKCES which, as part of its initiatives, leads production of labor market projections for the United Kingdom. These projections with a 10-year horizon, published under the name of Working Futures, are developed by the University of Warwick by commission from UKCES. They present a national picture with detail by sector and region. UKCES also organizes collection of the Employers Skills Survey along with more qualitative information.

As mentioned earlier, the Sector Skills Councils collect sectorial information on skill requirements. Some industry groups, such as the chamber of commerce and the Confederation of British Industry (CBI), also collect information on skill demand (Feldstein, 2015). For example, in a recent report, the CBI recommended reforms to attract more professionals into careers in science, technology, engineering and mathematics (STEM), in anticipation of mismatches in the future.

At local level, in 2010 the government announced the opportunity to create Local Enterprise Partnerships (LEPs) to stimulate the role of local authorities and companies in promoting development. There are now 39 LEPs whose fundamental objectives include providing consistent and detailed information on skill demand in the market so that training providers can respond effectively.

9. Conclusions

Skills imbalances are largely the result of failures that characterize the education and labor markets. First, individuals and training providers frequently make decisions based on incomplete information on the returns from each investment. Second, there is a lag between the time when individuals make training decisions and when they enter the workforce. In addition, as a result of institutional constraints and information asymmetries, wages do not always reflect the skills demand of the private sector. In this context, shortages or surpluses of certain skills or occupations are common and very difficult to prevent. If these imbalances are large and persistent, there can be significant economic and social costs.

This is why many developed countries have a long tradition of initiatives designed to anticipate skills demand. Despite their limitations, these initiatives can inform public policies on skills development, investments made by education and training providers, and career and training decisions made by individuals. Given the current context of rapid technological change in which demand for skills can change rapidly and unpredictably, these initiatives are becoming even more relevant.

Different methodological approaches are described in this document with illustrative examples. Given the differing strengths and weaknesses of each of these approaches, many countries use a combination of methodologies. In general, the most successful systems efficiently combine public and private efforts. In the case of the government, two tasks are essential. The first one is the **generation and processing of information** which can come from a variety of sources, such as administrative data and surveys. Household labor surveys provide information on the workforce and its distribution by occupation. Employer surveys are key sources of information on economic activity by sector and employment, as well as on skills demand. Administrative information on vacancies and job seekers is needed to obtain a real measure of the degree of tightness of the labor market. In some countries, governments have also taken advantage of the increasing availability of "big data," such as the data in digital platforms on labor supply and demand, to carry out this function.

The second task is the development of a system to classify industries, occupations and qualifications in order to make comparisons between sectors and over time. Developing a classification system of qualifications is particularly important if the ultimate goal of the system is to inform skills development policies.

The private sector also plays an essential role. First, employers play a key role in strengthening and validating projections and scenarios with specific sectorial information. The dynamism and speed of the transformation of many sectors of the economy, in a world of rapid technological changes and constant innovation, are fundamental elements to be considered in the process of anticipating skills demand. Second, private sector participation not only improves the quality of skills demand projections, but also adds value to the process itself. To the extent that the effort to identify future skills demand facilitates dialogue between the various stakeholders (government, companies, training providers), it creates a space for deliberation which undoubtedly enriches the design, monitoring and evaluation of skills development policies.

This report describes and classifies different methodologies to anticipate skills demand and characterizes the institutions leading these efforts around the world. However, it is worth mentioning that building an effective system to anticipate skills demand implies challenges that are not only technical but also institutional. **Systems to anticipate skills demand should not only focus on generating quality data but also on building processes to ensure that the information is effectively used in decision making.** The ultimate goal of these systems is to inform decisions made by households, firms, training providers and policymakers. To achieve this, the construction of quality data should be embedded in an institutional environment that enables stakeholders to access the relevant information and to make their decisions accordingly.

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Appendix 1 – Links of interest

1. Analysis of skill needs in Europe-CEDEFOP

   http://www.cedefop.europa.eu/EN/identifying-skills-needs/index.aspx

2. Analysis of skill needs in the United Kingdom -UKCES

   https://www.gov.uk/government/collections/the-future-of-jobs-and-skills

3. Projections of skill needs in the United Kingdom-Working Futures-
   University of Warwick

   https://www2.warwick.ac.uk/fac/soc/ier/research/wf/

4. Analysis of skill needs in New Zealand – New Zealand Department of Labour

   http://www.dol.govt.nz/lmr/

5. Projections of skill needs in Canada

   http://www23.hrsdc.gc.ca/w.2lc.4m.2@-eng.jsp

6. Employer survey on skill needs in the United Kingdom --UKCES Employer Skill Survey

   https://www.gov.uk/government/collections/ukces-employer-skills-survey-2013

7. Sectorial studies of skill needs in Europe

   http://ec.europa.eu/social/main.jsp?langId=en&catId=89&newsId=731&furtherNews=y es

8. Industry Training Organizations ---New Zealand
   http://www.nzqa.govt.nz/for-business/ito.do

9. AMS Skills Barometer

   http://bis.ams.or.at/qualibarometer/berufsbereiche.php