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## **Measuring Skill Gaps in Firms: the PIAAC Employer Module**

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# Abstract

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This paper introduces the Employer Module of the OECD Survey of Adult Skills (PIAAC), a new OECD survey designed to measure the imbalance between the supply of and demand for the skills needed in the workplace (skill gaps), and how this relates to companies' business strategy and hiring, training and human resource practices. The document first describes the added value of collecting such data, and the different streams of economic research it can contribute to. It then shows how the Module can complement worker-level information on skill imbalances collected in the OECD Survey of Adult Skills. Lastly, it presents the key technical features of the survey, including the questionnaire's conceptual development, the units of observation and coverage, the mode of administration, and the requirements for data cleaning and validation.

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# Résumé

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Ce document présente le Module Employeur de l'enquête de l'OCDE sur les Compétences des Adultes (PIAAC), une nouvelle enquête de l'OCDE conçue pour mesurer les déséquilibres entre l'offre et la demande de compétences nécessaires sur le lieu de travail (déséquilibres de compétences), et leur relation avec la stratégie d'entreprise et les pratiques en matière d'embauche, de formation et de ressources humaines. Le document décrit d'abord la valeur ajoutée de la collecte de ces données, et les différents courants de recherche économique auxquels elles peuvent contribuer. Il montre ensuite comment le Module peut compléter les informations sur les déséquilibres de compétences au niveau des travailleurs, telles qu'elles sont collectées dans l'Enquête PIAAC. Enfin, le document présente les principales caractéristiques techniques de l'enquête, y inclus le développement conceptuel du questionnaire, les unités d'observation et la couverture de l'enquête, le mode d'administration et les conditions requises pour le nettoyage et la validation des données.

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# 1 Introduction

1. Skill gaps or skill shortages are the direct consequence of an imbalance between the supply of and demand for the skills needed in the workplace. In a long-term perspective, given the slow pace of adjustment of human capital, persistent skill imbalances reflect a suboptimal allocation of resources, which can reduce overall economic growth.

2. In this context, skill gaps can be affected by firms' decisions on the way employees are hired, (re-)assigned to tasks or trained. The design of these company-level practices requires a better assessment of employers' skill requirements and what influences them, as well as a deeper understanding of the mechanisms firms put in place to respond to skill mismatches. These mechanisms include on-the-job training, variable pay systems, performance appraisal, job rotation schemes and worker replacement. This information cannot be collected via a household survey, as employees usually have limited information on the skill gaps firms face, and on the strategies management puts in place to address those gaps. Existing employer surveys in several countries confirm that meaningful information on skill gaps can be collected from employers instead.

3. This paper introduces the rationale for a survey of employers called the PIAAC Employer Survey Module on Skill Gaps (henceforth: "Employer Module", "Module", or "the Survey"), where PIAAC stands for the Programme for the International Assessment of Adults' Competencies. The Employer Module complements the standard PIAAC Survey of Adult Skills, a household-based survey which assesses the skills of the adult population and how these skills are used. The Employer Module collects information on the skills available at the company level, the skills that employers anticipate will be needed in the future, and the most frequent human resource practices used by employers. Relative to existing national employer skill surveys, the Module collects information in a consistent way across OECD countries, leveraging a common questionnaire across countries. The first wave of the Module was administered in five European countries between 2021 and 2022, as part of the European Continuing Vocational Training Survey.

4. This paper first presents the rationale for creating an international survey on skill gaps, introduces the questionnaire of the Employer Module and discusses its added value (Section 2). The Module's data can be used to shed light on several issues that have been left largely unexplored so far, such as: the way skill gaps affect firm performance; how this relationship varies with a number of the company's features, ranging from its technological capability and absorbing capacity, degree of product internationalisation, or some managerial and human resource practices; how human resource and managerial practices favour skills deployment at the workplace; and whether firms that provide more training experience fewer gaps or experience them in fewer or different areas compared to firms who do not train on a regular basis. Ultimately,

the collected information expands the evidence base for policy makers to design effective skills, labour market and industrial policies.

5. The Module further complements information on skill mismatches as reported by workers surveyed by the PIAAC Survey of Adult Skills. The frequency of skill gaps differs when surveying workers versus managers or employers. Both perspectives, however, are important for designing mitigating policies. Section 3 of this paper describes how the PIAAC Survey of Adult Skills and the Employer Module are linked at the conceptual level by using – for selected items – the same or very similar concepts, phrasing, and scales across the two surveys.

6. Beyond the conceptual level, the two surveys can be linked statistically by aggregating information from both sources at the sectoral and company-size level. At this level, information from other company-level databases could be linked in as well. In principle, a second statistical linkage would be possible at the micro level, if the two data collections were jointly designed, either by sampling individuals first and asking them for their employer's identifier, or choosing to survey employers first and then a selected sample of their employees. Both approaches have their shortcomings and impose a trade-off between greater administrative costs and the deeper insights derived from an employer-employee matched dataset.

7. Section 4 of the paper presents a number of technical specifications for the Module that are relevant to ensure the dataset's cross-country comparability and to maximise its analytical and policy relevance. The aspects considered include, among others: the questionnaire's conceptual development; the flow of questions and translation; the Module's units of observation and coverage; the mode of administration, along with the choice between a stand-alone and an add-on to an existing survey; and the requirements for data cleaning, validation and sharing with the OECD. For each of these aspects, the paper briefly summarises the choices made for the ongoing implementation of the Module in European countries. Section 5 concludes.



# 2 Why measure skill gaps in firms

## The rationale and added value of the Employer Module

8. Although there is no strict definition, skill gaps refer to a situation in which workers' (or job seekers') skills exceed or fall short of those required for their job under current market conditions (Shah and Burke, 2005<sup>[1]</sup>; OECD, 2017<sup>[2]</sup>).<sup>1</sup> This mismatch makes it difficult for individuals to find or retain jobs and for employers to find workers with the skills they need. Skill gaps can also include qualification mismatch (where an employee has qualifications that exceed or do not meet those generally required for the job), or field-of-study mismatch (where an employee is trained in a field-of-study that is different than the one generally required for the job).

9. In a labour market with imperfect information and high search costs, some degree of mismatch between the supply and demand for skills is a normal occurrence, especially within a short time span. Persistent skill imbalances, however, can be very costly for individuals, employers and society. They can lead to lower earnings and job satisfaction, lower productivity, and reduced economic growth, including via lower innovation and adoption of new technologies.

10. An employer-level survey on skill gaps aims to capture information from employers on skill requirements and skill development, as well as on the strategies companies are deploying to mitigate the consequences of skill gaps on performance. The basic added value from undertaking an employer level survey comes from the information it provides on the unmet demand for skills in private sector organisations and employer perceptions of skill gaps. On the one hand, this information, and in particular the pervasiveness of skill gaps across space, industry and firm size classes, has value per se since skill gaps, and in particular under-skilling, have received relatively little attention in the literature and in policy-making, compared to other forms of mismatch (e.g. over- and under-education, or overskilling), and to skill shortages (McGuinness, Pouliakas and Redmond, 2018<sup>[3]</sup>). On the other hand, by design, the Module is complementary to the background questionnaire in the household component of the Survey of Adult Skills (PIAAC). Through this linkage, it will be possible to compare and contrast employers' and employees' views on skill gaps (see next Section).

11. The second aspect of the Module's value added is the collection of information on the policies and practices employers implement to shape skills requirements and deal with skill gaps. Employers take decisions on how workers and production are organised, and consequently how skills are put to use in the workplace. They also set priorities for innovation, technology adoption and new products, and for the company's reorganisation, which in turns impacts the need for

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<sup>1</sup> Skill gaps and skill shortages / surpluses are therefore distinct concepts. Skill shortages (surpluses) arise when the demand for workers for a particular occupation is greater (lower) than the supply of workers who are willing to work under existing market conditions. There can be therefore skill gaps even without skill shortages or surpluses.

new skills or the rate at which existing skills are depreciating. They also initiate or sign off on investment decisions, including on human capital and training of the workforce. For example, ICT adoption may be connected with higher work intensity (Chesley, 2014<sup>[4]</sup>) and with changes in the locus of decision making in the firm (Garicano and Rossi-Hansberg, 2015<sup>[5]</sup>). ICT adoption further determines the composition of the firms' workforce, if it can substitute for labour in certain routinized manual and cognitive tasks (Autor, Levy and Murnane, 2003<sup>[6]</sup>), and possibly even for cognitive skills thanks to recent advances in AI or machine learning (Frey and Osborne, 2017<sup>[7]</sup>).

12. Training and skills development practices can therefore enhance productivity on the job by improving how well workers' skills match those required in their job tasks, as well as workers' professional or even personal growth. Firms, in turn, can become more efficient, and adapt faster to changes in production and task requirements.

13. The current version of the Employer Module's questionnaire is reported in Annex A. It has several features that are designed to maximise its value added, while remaining parsimonious in the number of questions asked:

- The **core** items focus on the most important concepts surveyed in the Employer Module. The "core" is composed of five items on skill gaps and the firm-level changes which may have caused them (Q1 to Q5), and five essential questions on the firm's background (sector, location, size – Q6 to Q10), which are needed to contextualise the Module and link it to other data sources.
- A set of **optional questions to the core** add value by identifying correlates that can help draw policy-relevant messages. These items help investigate firm differences in the consequences of skill gaps; companies' innovation capability; human relations (HR) and work organisation practices implemented in the company; difficulties in recruiting and recruiting strategies. The current design of the questionnaire for the Module allows countries to choose among these additional aspects, based on the relevance for their own policy priorities. This feature was designed to limit the survey's length and implementation cost, although some of these questions may already be present if the module is embedded in an existing employer survey.
- The Module is completed by a second set of optional questions that cover related but different topics than the core. These **desirable** items explore firm-level strategies to tackle skill gaps. Different desirable modules collect information on the firm's training practices (Section 2.B), workplace organisation and managerial practices (Section 2.C), and new recruits (Section 2.D). Countries can choose to add some or all of the "desirable" items. Again, some of these questions may already be present if the module is embedded in an existing employer survey.

14. The key novelty of the Employer Module remains its "core", which focuses on the extent to which firms face skills gap in the employed labour force, on which skills and for which reasons, and which strategies are put in place to mitigate the impact of skill gaps on the companies' operations.

## The Module's core: measuring skill gaps in firms

15. The core of the questionnaire tackles important questions such as the type of skills that firms have the hardest time finding in their workforce, and how these are related to one another; the challenges – especially those related to technological change – that are most likely to cause skill imbalances in the firm, and how these are affected by contextual and institutional conditions; and the role of the firm's own strategies to tackle skill imbalances. This information can motivate policy actions aimed at minimising the occurrence of skill mismatches, but also policies that aim at stimulating learning at work and maximising the returns of human capital investment.

16. Qualification mismatch is typically easier to measure than skill mismatch, because information on workers' education is more frequently available than data on their skills. However, this may be a poor proxy for the gap between the actual skills that workers possess and those required by employers. For this reason, and with an eye to maximise the value of a new data collection effort, the PIAAC Employer Module focuses on a more direct measure of skill mismatch than qualifications.

17. An existing body of economic literature has indeed explored the channels through which skill imbalances affect productivity.<sup>2</sup> A first set of studies examines how firm productivity is affected by *skill shortages*. Haskel and Martin (1993<sub>[8]</sub>), Tang and Wang (2005<sub>[9]</sub>), Forth and Mason (2006<sub>[10]</sub>), and Bennett and McGuinness (2009<sub>[11]</sub>), for instance, find that skill shortages have a negative impact on firm productivity. Multiple mechanisms may be at play, but the most obvious drivers of this negative relationship are the higher bargaining power of workers in the presence of skill shortages, or the necessity for employers to hire less productive workers than envisaged to fill the position. Furthermore, Nickell and Nicolitsas (1997<sub>[12]</sub>) provide evidence that skill shortages reduce the likelihood of a firm's investment in R&D and in other fixed capital goods, while Haskel and Martin (2001<sub>[13]</sub>) find that shortages are more likely in establishments using advanced technologies. Firms wanting to reduce the impact of skill shortages on production can adopt a variety of solutions, from increases in salaries to better working conditions, to recruitment of skilled workers or outsourcing (Healy, Mavromaras and Sloane, 2015<sub>[14]</sub>). In presence of market rigidities or imperfect information, workers are not necessarily allocated to jobs according to their skills or qualification, thus lowering their productivity at work, and the overall allocative efficiency of the economy (Adalet McGowan and Andrews, 2015<sub>[15]</sub>).

18. Under-skilling depresses firm productivity as workers have lower skills than required, and therefore cannot fully perform on their job. This, in turn, can decrease salaries and/or job security for the worker. Under-skilling can be the result of skill shortages in the market (so that firms are forced to hire under-skilled workers to fill the vacancy), asymmetric information (as long as firms select workers on educational attainments which do not necessarily correspond to actual skills),

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<sup>2</sup> What follows reviews the existing economic literature on skill imbalances and firm productivity, mostly finding a negative relationship. It should not be forgotten, however, that overeducation and overskilling may be optimal in the firm equilibrium, if the extra marginal productivity generated by positive imbalances is not met by equivalently higher wages for workers. Similarly, firms may find it optimal to hire undereducated and/or under-skilled workers if their lower productivity is more than compensated by lower wages. A more accurate perspective would therefore consider the simultaneous wage and productivity effects of skill mismatch, an approach followed by a very limited number of studies instead.

or an explicit strategy of the firm, which hires under-skilled workers with the aim of raising their skills through training.

19. Overskilling identifies a situation in which workers' skills are not fully used, often according to the employee (Mavromaras and McGuinness, 2012<sup>[16]</sup>). If an overskilled worker could be very productive if she applied her superior skills to process a task at a faster pace, this is usually not fully rewarded – as the effect of overskilling on wages (Mavromaras, McGuinness and Fok, 2009<sup>[17]</sup>) and job satisfaction (Green and Zhu, 2010<sup>[18]</sup>) is negative. As a consequence, the net result of overskilling on firm productivity is negative.

20. A third set of studies, finally, focuses on qualification (education) mismatch. As educational and skill mismatches are usually correlated but not very strongly (Allen, Badillo-Amador and Velden, 2006<sup>[19]</sup>; Green and McIntosh, 2007<sup>[20]</sup>), the productivity impact of skill and education mismatches are not expected to mirror each other. Kampelmann and Rycx (2012<sup>[21]</sup>) analyse the impact of education mismatches on firm productivity, relying on linked employer-employee datasets from Belgium. They find that firm productivity is positively affected by overeducation across workers of any age, and negatively affected by the undereducation of young workers only, since older workers can compensate for their undereducation (often, the lack of formal schooling) through work experience and training. Similarly, Kampelmann et al. (2020<sup>[22]</sup>) find that undereducation (resp. overeducation) is associated with lower (resp. higher) firm profits, and especially in firms operating in high-tech sectors or under economic uncertainty, as in Mahy et al. (2015<sup>[23]</sup>). The positive effect of overeducation on productivity is further magnified in presence of firms' corporate social responsibility actions, which improve the firm-worker match and extend the length of the working relationship (Giuliano et al., 2016<sup>[24]</sup>). Grunau (2016<sup>[25]</sup>) provides supporting evidence of a negative relationship between undereducation and establishment productivity, based on German data, but not of a positive relationship between overeducation and productivity.

### Questions on the firm's business model

21. The relationship between skill imbalances and firm performance is likely to vary with a number of the company's features, ranging from its technological capability and absorbing capacity, degree of product internationalisation, managerial profile, and with some specificities of the product market (CEDEFOP, 2018<sup>[26]</sup>). The Employer Module thus gathers information on the firm's industry affiliation and some firm characteristics, such as the main industry of operation and the size of their employment.

22. Sectors differ significantly in their intensity in skill- and educational mismatches, with the service sector being especially negatively affected through lower job satisfaction of workers (McGuinness, Pouliakas and Redmond, 2018<sup>[3]</sup>). Overqualification is found more frequently in small private companies, and for some low-skilled occupations in particular, such as elementary occupations, service and market sales workers, plant and machine operators and assemblers (CEDEFOP, 2018<sup>[26]</sup>).

23. Size and industry of affiliation, in turn, may serve as proxies of other firm- and industry-level characteristics that are more directly related to skill imbalances.<sup>3</sup> As employers are in a better position than employees to give information on aspects of the firm's market and new product and service development strategy that impact on skills development, the Employer Module includes two optional questions on the degree of innovativeness of the firm's production, and on the main composition of the firm's workforce. Employers are also expected to know better than employees what the main market for the company's final products is.

24. A firm aiming to upgrade the quality of its final products or to introduce new products or processes likely requires a change in the skills deployed in production. People generate the ideas and knowledge that create innovation, and they apply this knowledge and the resulting technologies in the workplace, thus raising the firm's ability to absorb new technologies. If a firm's workforce lacks the ability to learn and adapt at sufficient speed, the company's strategy may generate skill imbalances and incur in a delay or even fail. Using UK data, Tether et al. (2005<sub>[27]</sub>) find that over one fifth of firms believe that skill gaps delay the introduction of new products and one third of firms believe that skill gaps are a barrier to the introduction of new work practices. Toner (2011<sub>[28]</sub>) reviews the relevant literature and finds a strong causal linkage between higher levels of education, training and skills and increased demand for and supply of innovation, meant both in the sense of changes in products and processes. A final set of studies also shows that the strength of the employer-employee working relationship can impact the way human capital translates into innovation at the company level, as in e.g., Cetrulo et al. (2019<sub>[29]</sub>). For product innovations in particular, which tend to be less disruptive, the firm heavily relies on workers' creativity, itself a function of their on-the-job specific experience. Intermittent job relationships therefore typically decrease the rate of product innovation.

25. In firms displaying skill imbalances, moreover, the workforce may not be well suited to cater the larger or international market. A vast empirical literature provides evidence that trade liberalisation increases the demand for skilled labour (Bernard and Jensen, 1997<sub>[30]</sub>; Bernard et al., 2007<sub>[31]</sub>). Multiple channels may be at play: an increase in export, for instance, translates into an expansion of production for the most skill-intensive firms, which are the most likely to serve the export market (Goldberg and Pavcnik, 2007<sub>[32]</sub>; Harrigan and Reshef, 2015<sub>[33]</sub>). Alternatively, firms may upgrade the skill intensity of their workforce and the innovation content of their production, so as to survive a tougher competitive environment, both at home (if domestic products are substituted for foreign, imported ones) and abroad (on the export market) – see e.g. Thoenig and Verdier (2003<sub>[34]</sub>) and Bustos (2011<sub>[35]</sub>). Ample evidence therefore exists that trade liberalisation can cause skill-biased technical change (Attanasio, Goldberg and Pavcnik, 2004<sub>[36]</sub>). Other, more recent papers, find instead that globalisation has reduced the employment prospects of middle-skill workers (often, workers in middle-skill occupations), while sustaining or enhancing those of high- and low-skill workers (Autor, Levy and Murnane, 2003<sub>[6]</sub>; Goos, Manning and Salomons, 2014<sub>[37]</sub>). Such employment polarisation can translate into skill shortages if labour relocates slowly across occupations and sectors, itself a function of the institutional landscape, the size of the adjustment required, and the workforce composition before the shock (Brunello and Wruuck, 2021<sub>[38]</sub>).

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<sup>3</sup> The case of human resource practices and work organisation is covered later in the paper.

## Desirable questions on human resource management and work organisation

26. Conditional on the same technology of production, the quality of the worker-to-firm match (and hence the existence of skill gaps) is determined by the organisation and strategy of recruitment, the recourse to internal labour markets or new hires, and training policies.

27. Good management practices (lean operations, performance and target management and talent management optimising the quality of the workforce) are positively correlated to productivity, and so are cross-country differences in both (Bloom and Van Reenen, 2007<sup>[39]</sup>). Bloom et al. (2015<sup>[40]</sup>), for instance, find that half of the difference in average TFP between firms in the US and EU Mediterranean countries can be explained by differences in “management capital”, measured as a number of advanced managerial and HR practices. Bender et al. (2018<sup>[41]</sup>) add that managerial practices can affect firm productivity by selecting better quality workers and implementing pay schemes that elicit workers’ efforts. In their study, the productivity-enhancing impact of managers’ skills is separated from that of managerial practices themselves.

28. Many of the managerial practices analysed by Bloom and Van Reenen (2007<sup>[39]</sup>) deal with the incentives for skills acquisition and deployment within the firm. Firms continuously make organisational choices on the way tasks are distributed across workers, so that their skills adapt to the changing needs of the workplace. Employer’s decisions on different management practices shape the organisation’s design, which in turn affect how skills are used at the workplace as well as their further development over time. Employer strategies that favour skills deployment at the workplace while enhancing both employers’ and employees’ outcomes hinge on the development of suitable human resource and managerial practices. Detection of skill mismatches, understanding the skill needs of operations, and frequent performance appraisal to review skill needs and link it to pay provide incentives for workers to develop and adapt their skills to production, and moderate the frequency of skill mismatches. The literature on Japanese production methods – as in e.g. Young (1992<sup>[42]</sup>) – points to the positive role which the adoption of practices such as quality circles, job rotation schemes, autonomous teams and project groups can play in enhancing the firm’s capacity for incremental learning and innovation.

29. The Employer Module investigates two of these aspects of organisation and HR management. An employer survey is especially suited for such questions: managers are much better informed about the firm organisation as a whole than most individual employees. They can also describe the role of human relations strategies to face the firm’s economic difficulties and difficulties in the deployment of suitable skills for production.

## Desirable questions on training practices

30. A most evident strategy employers can deploy to reduce the extent of skill gaps, and in particular under-skilling, in the company is investing in workforce training. Encouraging lifelong learning and increasing participation in adult learning opportunities addresses the under-skilling issue and prepares individuals to possible further future adjustments in skill requirements in the firm. Furthermore, training can support workers whose skills are becoming obsolete, for instance because of aging or of a technological transition. This of course requires a regular assessment of skill needs in the firm’s workforce. The Module explores all these aspects of firms’ training practices.

31. Leveraging data from Ireland, McGuinness and Ortiz (2016<sup>[43]</sup>) find that tackling skill gaps is a fundamental reason for firms to invest in training. However, training and wages can be de-facto substitutes for workers to exert higher effort at work and for the firm to leverage their human capital (Healy, Mavromaras and Sloane, 2015<sup>[14]</sup>). The firm's optimisation plan may result in an explicit preference between one of the two strategies, depending on the tightness of labour markets or firm's preferences for contract types and employee turnover (Wieling and Borghans, 2001<sup>[44]</sup>; Stevens, 2007<sup>[45]</sup>). Especially in the case of under-skilling, firms may choose to hire an under-skilled worker and offer training, rather than hire a more educated, costlier worker. The likelihood of this occurrence would vary with the nature of the skills required in production, and likely be higher when skills are specific to the particular firm's products and processes.

### Desirable questions on hiring practices

32. One last set of employer practices has a direct impact on the skill composition of the firm's workforce, and the occurrence of skills mismatches at the workplace: recruitment policies. Firms seeking to fill a vacancy can indeed choose to hire a new, better skilled individual rather than retrain an existing worker. Firms compare the fixed cost they have to incur to screening the market versus retraining existing workers, and evaluate them against the probability that a skilled (or retrained) worker may move to a different company.

33. The occurrence of new recruitments versus retraining is rooted in a number of observable firm- and contextual characteristics, some of which can be analysed through the data collected in the Employer Module. For instance, the ability to screen the market for new hires increases with the firm's size (Forsythe and Weinstein, 2021<sup>[46]</sup>), but so does the propensity to offer training to employees, for example because the fixed cost of designing training is shared on a larger number of workers (OECD, 2019<sup>[47]</sup>). Lastly, large firms are less likely to lose workers to competitors than small firms (Croce et al., 2017<sup>[48]</sup>). The type of skills sought for by hiring rather than training becomes therefore of key importance, as firms more easily appropriate the returns to training on specific rather than generic skills (Acemoglu and Pischke, 1999<sup>[49]</sup>).

34. In this context, the difference between skill shortages and skill gaps becomes especially important, with skill shortages identifying a lack of candidates with the required skills in the market and skill gaps referring to a lack of certain skills in the firm's current workforce. An insufficient supply of skills in the economy likely translates into firm-level skill gaps. In that case, firms have the option to rebalance supply and demand by adjusting wages, working hours, or qualification requirements (Wieling and Borghans, 2001<sup>[44]</sup>). Fang (2009<sup>[50]</sup>) shows that employers respond to skill shortages in the hiring process not by raising wages, but by redesigning jobs, increasing flexible hours, and creating self-directed groups and problem-solving teams. From a different angle and based on U.S. data, Weaver and Osterman (2017<sup>[51]</sup>) do not find a positive and significant correlation between a firm's hiring difficulty and the regional skill supply, including in high-tech sectors, which are particularly affected by skill shortages.



# 3 Further value added from linking with worker data

35. Employees and management can vary substantially in their perception of skill-related challenges at work and these differences are important for policy makers trying to assess the pervasiveness of skill gaps in the economy. These differences in views represent important information for policy makers. First, if stakeholders differ too much in the understanding of the issues at stake, building consensus on appropriate skill development policies is harder. Second, these differences may reflect a lack of awareness of actual skill gaps on the part of some employers and workers. In both cases, greater efforts should be made to disseminate better information on skill gaps and the underlying causes. In fact, both employees' and employers' points of view provide useful information for policy making, as observed differences can be compared and discussed by social partners and the stakeholders involved in vocational education and training policies and they can serve as the starting point for the (re)design of skills, labour or industrial policies.

36. Beyond cross-referencing the same concepts, complementing the information collected through a household survey with data collected through an employer survey allows for much richer and nuanced analysis for policy. Employer-based information provides useful context for the description of skills' use provided by employees. Employee-based information, instead, complements employer-level data on topics that cannot be easily observed by an employer, such as work intensity or work discretion. More broadly, the combined information on skills requirements can be used to improve the design of life-long learning policies, which in turn can enhance firms' competitiveness and workers' success in the labour market.

37. Combining employer-based and employee-based information is also important from the methodological point of view, insofar as it allows for the better empirical identification of certain economic phenomena linked to skills development and use. Indeed, this leaves fewer characteristics unobserved, thus reducing the potential bias in the empirical estimates and enhancing the correct understanding of the skill-related phenomenon of interest.<sup>4</sup>

## Employers' and employees' perception of skill gaps

38. As mentioned, asking employers and managers about skill gaps has potentially some important analytical advantages, as managers are much better informed about the whole organisation than most individual employees are, and they can describe the competitive

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<sup>4</sup> Matching employer and employee information also provides two different measurement spaces, which can help finding exogenous variation in the data and reduce the impact of endogeneity on the analysis.



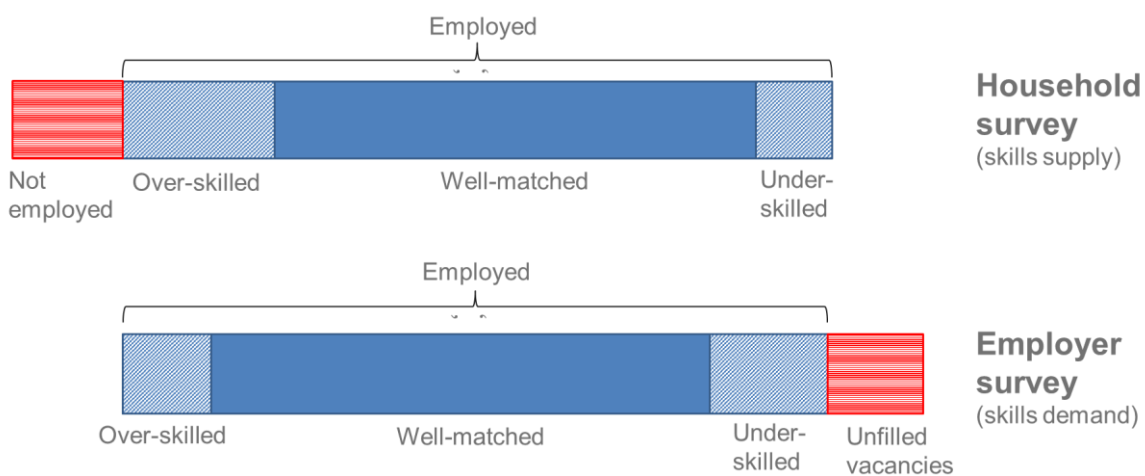
environment of the company and the economic difficulties or successes they encounter. Critically, during a pilot survey conducted by Cedefop in view of developing an employer survey, a vast majority of managers felt that they could state whether each skill type present in their company was staying the same or changing in importance in the near future (Cedefop, 2013<sup>[52]</sup>). They were also able to inform interviewers when there was a particular new skill requirement that was emerging, either a generic or an occupation-specific skill.

39. That is not to say, that the employee perspective has no value. Some contextual information on the workplace can be better provided by employees, particularly when the focus of analysis is the exploration of the impact of workplace features on workers' jobs and attitudes at work. Importantly, workers possess the best information on the competences required to be proficient in their jobs, as well as the best understanding of what their own skills are. For managers, this asymmetry of information implies a more limited understanding of the extent of skill gaps in the company. As a consequence, employers are less likely to report skill-gaps relative to employees. McGuinness and Ortiz (2016<sup>[43]</sup>), for instance, report that less than 50 percent of firms in Ireland recognised gaps when they were reported by employees.

40. Employees, however, rely on their perception to assess their own performance, and this subjective view of the adequacy of their skills is in principle no more or less biased than the manager's subjective view on whether the company's skill demands are met, at least compared to what a third external evaluator would state. In Figure 1, this is represented by the asymmetry in the incidence of over-skilling and under-skilling as recorded by a household or employer surveys, whereby employees tend to find themselves over-skilled more often than under-skilled, while managers and employers typically have the opposite perception. Figure 1 also highlights how employer surveys are well suited to collecting information about unfilled vacancies and their relation to skill imbalances, while household surveys can describe the mismatch of the individuals who are not in employment.

**Figure 1. Differences in perception of over- and under-skilling between employees and employers**

Stylised representation



Source: OECD.

## PIAAC household and employer surveys: the conceptual link

41. In order to collect data on skill mismatches from both employer and employee perspectives, the PIAAC Employer Module on Skill Gaps was explicitly designed to link to the Background Questionnaire of the PIAAC Survey of Adult Skills, which is administered to individuals randomly selected within a sampled household. This linkage is envisaged both at the conceptual and statistical level.

42. The conceptual linkage is obtained by aligning the content of the Employer Module and Household questionnaire using consistent concepts for skills, training and HR practices. For questions in the “core” of the Employer Module, a strict correspondence is sought for in concept and exact phrasing with questions in the second cycle of the PIAAC household questionnaire, as reported in

43. Table B.1 in Annex B: the types of skills for which skill mismatch is measured, as well as the macro-trends which are most likely to affect it, are the same across the two questionnaires. The same verbatim correspondence applies to the Module’s “essential” questions (location, firm size and sector of affiliation).

44. For “desirable” questions in the Employer Module, the correspondence at the conceptual level remains, but is not as strict: questions that are conceptually related across household and employer questionnaire gather a common sub-set of information, but also expand the data collection in directions that the other survey does not contain. As a consequence, the *verbatim* correspondence is broken. Items for which this is the case are reported in Table B.2. These are “desirable” questions about the extensive margin of training and firms’ internal organisation or HR practices. To achieve comparability, some further data manipulations may be needed.<sup>5</sup>

45. The Employer Module further collects information on the structure of the firm’s workforce in terms of occupation (blue- versus white-collar), age (above/below 50 years of age), contracts’ duration (temporary versus non-temporary contracts) and self-employment, and the same information is gathered from individuals in the household-based PIAAC Survey, which can then be summarised at an aggregation level that is consistent with the structure of the Employer Module.

46. Finally, a conceptual link between the two surveys also exists for items that are not present in both surveys but provide complementary information. One example among many is information on the employee’s work organisation (flexibility in the order and nature of tasks and in the speed of work; collaboration and sharing information with colleagues; negotiating, training and teaching others; flexibility in working time) as collected in the household questionnaire. Although there is no correspondence with items in the Employer Module on these topics, data on firms’ internal organisation, HR practices and the pervasiveness of skill gaps can be used to better interpret the information from the household survey.

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<sup>5</sup> For instance, it is in principle possible to compare the frequency of training in an economy as reported by PIAAC and the Module, but the sample in the household survey should be restricted to individuals that are employed, to job-related training only, and possibly to training paid by the employer and carried out during working hours – all questions that are asked explicitly in the PIAAC household questionnaire.

## PIAAC household and employer surveys: the statistical link

47. Beyond the correspondence between surveyed concepts, the data collected through the Employer Module and the PIAAC Background Questionnaire can be linked at the statistical level. Multiple approaches can be envisaged to this goal, but they can be grouped into two main approaches: building a link at the intermediate level, and at the individual (worker) level.

### ***Linking at the intermediate level***

48. A link at the intermediate level translates into the construction of a single dataset containing data sourced from the employer and household questionnaire, once aggregated at a pre-determined, common level. A coherent sampling strategy and the use of appropriately designed sampling weights ensure the representativeness of information sourced from the two surveys. As employer surveys are usually stratified by industry and company size, it is expected that the intermediate-level linkage between employee and the employer information will be carried out by industry and size. These are meaningful dimensions for the analysis of skills, and the linked data can be complemented by information sourced from other firm level surveys or by administrative data, once aggregated at the same level. Examples of such ulterior data sources are proposed in Section 2 here above.

49. The level of disaggregation of industry- and size categories at which the link will be performed depends on: (i) the existence of common categories across the two data sources; and (ii) the number of entities sampled in each resulting cell. While (i) was ensured while designing the Employer Module's questionnaire (see previous section), (ii) can be a challenge for the data collection phase, and a pre-determined sample size may constrain the level at which data can be aggregated, and ultimately the possibility to use the two data sources jointly.<sup>6</sup>

### ***Linking at the individual (micro) level***

50. A link at the individual level implies the possibility to connect information provided by a given worker (or a representative worker with equal features), to information about her very same employer (or a representative employer with equal features). Such a combined dataset allows for a direct link between the policy undertaken by employers (training, HR, and other responses to skill gaps) and the skill proficiency, skill use, job satisfaction and wages of their own employees.

51. Currently the PIAAC Household Survey and the Employer Module run separate data collections, so linking individuals and firms can only happen once the data have been collected (*ex-post matching*). However, *ex-post* linking individual records originated from two surveys with different sampling frames incurs in significant challenges. In absence of unique identifiers that facilitate the linkage, matching individuals to employers is challenging and noisy by construction. This mainly stems from the fact that a small percentage of all firms in a geographical unit – typically, large firms organised in multiple establishments – employ a large percentage of all workers. Therefore, a large fraction of individuals surveyed by a household survey is employed

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<sup>6</sup> If, for example, 4 sectors and 5 size classes were chosen as a suitable aggregation level for linking the two data sources, and assuming 30-50 observations per strata, the Module's sample would have to contain 600 - 1 000 employers.

in a small subset of employers, while the remaining individuals need to be matched to a large number of small employers. Choosing the optimal match for the latter individuals is statistically challenging and requires specific techniques, each with its own shortcomings.<sup>7</sup> Nevertheless, considering the state of the data collection for both the PIAAC Employer Module and the second wave of the Household Survey, this would be the only available option for an individual-level match.

52. Alternative ways of creating an individual match would require an ex-ante intervention in the structure of data collection, and the sampling strategy in particular. One such way is the joint surveying of employers (or managers) and their employees, guided by a pre-designed common sampling strategy. This is equivalent to constructing a linked employer-employee dataset (LEED). Over recent decades, a large number of national linked datasets have been created, but international linked datasets are much less common (Greenan and Seghir, 2015<sup>[53]</sup>), including for example: the OECD Teaching and Learning Survey (TALIS), which restricts its focus to one sector of the economy (education), and the Eurostat Structure of Earnings Survey (SES). Such sparse number reflects the inherent difficulties of collecting linked records across countries, especially outside the remit of a common official statistical system, such as the one enforced by Eurostat in the European Union. Furthermore, even among the national-level LEED, few are designed for the purpose of analysing skills and training policies: the French *Dispositif d'information sur la formation employeur-salarié* (DIFES) and the British Skills Survey/Employer Perspectives Survey (BSS/EPS). Other LEEDs contain some information on training, skill requirements, or firm organisational practices (Kampelmann and Rycx, 2012<sup>[21]</sup>; Mahy, Rycx and Vermeulen, 2015<sup>[23]</sup>).

53. Among LEED data, some sample the employee first, and derive the sample of employers from them (*employee-employer surveys*), while others sample employers first, and employees in each entity only at a later stage (*employer-employee surveys*). PIAAC countries can choose either route, although each option has its strengths and shortcomings.

54. An *employee-employer* match requires interviewed individuals to report the name of their employers, which can be then used to contact the employer, or to report their social security number, which can then be linked to an employer through administrative data. This approach relies on an already-existing sampling and weighting strategy (PIAAC), possibly complemented with additional information from other national household databases. The resulting data are generally believed to be of higher quality than in the case of employer-employee datasets, and to be affected by fewer problems in guaranteeing the anonymity of surveyed employees with respect to their employer (Greenan and Seghir, 2015<sup>[53]</sup>). Furthermore, an employee-first approach covers employers of all kinds (including the self-employed) and can easily produce a

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<sup>7</sup> In deterministic file matching, the researcher identifies a set of variables that are common to a given surveyed unit in both files, thus creating a set of possible matches. Matches are unequivocal, however, for a small subset of all records, thus making the final matched dataset a limited and non-random selection of the population. Probabilistic linking methods, instead, allow choosing the best match from a set of potential matches and non-matches, as identified by the probability that a particular feature is coherent across the two data sources. A cut-off is then calculated from the data, distinguishing “true” from “false” matches. Some manual intervention is often required at this stage. More recently, Abowd et al. (2019<sup>[54]</sup>) use a supervised machine learning model to probabilistically link survey respondents. This avoids having to select the one exact match with the highest matching probability, or with a sufficiently high probability as defined by an ad-hoc probability cut-off.

representative picture of the population of firms, as the sample of employers derived from a random sample of employees reflects the employer unit's share in total employment. Lastly, the information on an individual's employer may already be available in countries where the quality of business register data is high.

55. In the context of the OECD Survey of Adult Skills, a link could be built starting from the surveyed employees, who would be asked to provide the identifier of their employer. In practice, employees may refuse to report the name of their employers, or the employer may have exited the market in the meanwhile. Second, certain particular types of companies (such as self-employed in sectors where self-employment is rare) may still be missing from the final sample, if their employees are not surveyed in the PIAAC Household Survey in the first place. Lastly, employees may be able to identify the address of the establishment in which they work, but not necessarily that of the enterprise, thus suggesting that an employee-first approach is more coherent with an establishment-level rather than enterprise-level employer survey.

56. An *employer-employee (employer-first)* approach, conversely, samples employers first. A sample (or even the entirety) of the firm's employees is then administered the household questionnaire. Even in the presence of a good quality employer sample, however, there is no guarantee that the resulting sample of employees is representative of the population of workers. Employees of small and very small businesses may be reluctant to be interviewed, if they perceive that their responses can be traced back to them by the employer. When this is not the case, the choice of the employees to survey remains crucial: the researcher can run a randomisation procedure within the employer's unit, but this is typically rather costly. In alternative, employers can be asked to provide a list of employees, which would likely skew the sample towards employees who are in good relations with the management, and therefore bias the evidence towards an overly positive view of the company's skill practices.

57. In the context of the OECD Survey of Adult Skills, a parsimonious choice for countries choosing an employer-first approach would be to administer to the employees in the sampled firms the online version of the Survey, i.e., the Education and Skills Online assessment. An employer-employee approach is the only option where countries aim to leverage an existing survey as a vehicle for the PIAAC Employer Module. Countries creating a standalone survey for the Employer Module do not have to choose an employer-first approach, but if they do, maximising the added value of an individual linkage of the household and employer questionnaires requires a careful evaluation of the quality of their national register, and of the coverage of very small businesses and of all sectors of the economy in particular.

# 4 Technical specifications for the PIAAC Employer Module

## Questionnaire development

58. The current PIAAC Employer Module is the result of a multi-year process that required developing the questionnaire, finding a suitable form for its administration across countries, and assisting participating countries with the survey operations.

59. *Choice of questions.* The Employer Module questionnaire was first developed by a group of international experts (see Annex C), who met at regular intervals, between 2016 and 2018. Several successive drafts of the Employer Module were discussed by member states' delegates at OECD official gatherings for PIAAC-participating countries (the PIAAC Board of Participating Countries, or BPC) in 2016-2020. The questionnaire was also discussed with Eurostat delegates in an ad-hoc workshop in December 2018, and the feedback incorporated in the current questionnaire.

60. Particular attention was paid to the phrasing of questions to ensure that they are easy to understand, appropriately capture the underlying concepts, and are comparable across countries.<sup>8</sup> Each item is a one-concept question, to the extent possible. Answer options and scales across items were streamlined, so as to simplify the questionnaire and minimise completion time.

61. Four out of the five “core” questions on skill gaps were derived from established surveys which have been implemented for several rounds. The phrasing of several items was taken from other national and international surveys (UK Employer Skill Survey, EuroFund European Company Survey, Cedefop Employer Survey Pilot, Australian NCVET Survey of Employer Use and Views of the VET System, and MEADOW framework). All the surveys from which the items are taken went through thorough testing and piloting and many have been in the field several times by now, which underscores how the items can appropriately capture the intended concepts and can be clearly understood by respondents. Lastly, some questions were phrased according to the Background Questionnaire of the second cycle of the PIAAC Survey of Adult Skills, administered to households.

62. *Order of questions.* The order of questions can influence the respondent's understanding of the item, as well as the speed and coherence with which the item and following ones are

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<sup>8</sup> Examples of key concepts that required careful consideration of wording are staff (employed persons or employees), company (enterprise or firm), skill types, training activities.

answered. Participating countries should therefore strive to keep the same order of questions in each country. Some questions follow from each other conceptually, or because of the filtering that an answer imposes on others. The Module’s “core” can thus be split in four main blocks: a first block includes the questions on under-skilling, as filtered by Q1 (Q1, Q2, Q3 and QA1); a second block discusses the firm’s investment or strategic choices that may have engendered the skill gaps (Q4, Q5); a third block includes questions on the firm’s innovation capabilities (QA2, QA3), and a fourth block contains the “essential” questions (Q6 to Q10). Overall, it is suggested that the Module is kept as a whole.

63. *Translation.* The translation of the Module’s questionnaire into the national language ensures that concepts are not distorted, which would reduce the comparability of results across countries. The translation of the Employer Module is performed by participating countries, with the assistance of the OECD and its contractors for consistency and verification. Further synergies for translation are derived from exploiting the linkages between the Module and the Background Questionnaire of the PIAAC household survey.<sup>9</sup>

64. *Duration.* Estimating the expected length of administration for the current questionnaire is not a straight-forward exercise, and it usually relies on a pilot. The mode of delivery is a key determinant of such length. The Module’s questionnaire is designed so that it can be delivered using any potential data-collection method, although some methods are expected to be more efficient than others.

65. It is expected that most participating countries administer the Module by Computer-Assisted Web Interviewing (CAWI), which is currently a common form of surveying employers in OECD countries. Far less costly than paper-based interviews, CAWI is an easily accessible and clear data collection mode, as it simplifies the routing of questions and blocks of questions according to the firm’s choices during the survey and minimises the errors in ex-post data entry and editing. Furthermore, relative to alternatives such as computer-assisted personal or telephone interviewing, CAWI allows respondents to answer at their own pace, consult additional sources ahead of responding, and return to previous sections of the questionnaire to fill unanswered questions or amend previous entries. This is especially important for employer surveys, where respondents are expected to report information on a potentially large set of business functions and individuals (the employed persons).

66. The Australian Government Department of Employment, Skills, Small and Family Business reported on a limited trial on one version of the Module, as part of an ongoing telephone-based survey. Some individuals were surveyed by phone, others with the support of a hard copy form. The questions took an average of four minutes when delivered in the written version.

## Delivery Mode

67. The Employer Module can be delivered as a stand-alone international survey, or as an add-on to an existing employer survey. In addition to sizeable savings in implementation costs,

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<sup>9</sup> An extra step in the questionnaire development is the cognitive testing of questions. As the bulk of the Module’s questionnaire is derived from existing surveys, this step was skipped.



the second option could add significant value to the host employer survey by leveraging its content further with links to skill gaps and employers' skill-development practices. The OECD and Eurostat have agreed that the Continuing Vocational Training Survey (CVTS) is a viable host for the Module for European countries (see Box 4.1). For non-European countries, using different hosting surveys or developing stand-alone instruments are still available options.

68. Against the several cost advantages, using an existing survey to host the Module poses some constraints that vary with the hosting survey. Among other aspects, the host survey could determine the choice of the: (i) role within the sampled company of the actual respondent, (ii) unit of observation, (iii) reference period, and (iv) coverage in sectors and firm type and size.

69. *Respondent's role in the company.* The job profile of the respondent to the survey's questionnaire is crucial for the responses' quality and comparability across units of observation. The recommended recipient for the Employer Module is the company's human resource managers, where the role exists, as they are assumed to have a better picture than line managers of the company's skill gaps and training, HR and management strategies. When a human resource manager is missing, as is typically the case in small and micro firms, the company's general manager or director is the most appropriate recipient.

70. *Unit of observation.* The unit of observation in employer surveys are usually the company/enterprise/firm or the establishment/local unit.<sup>10</sup> The ideal observation level depends on the issues being investigated and the questions being asked. For strategic considerations on training and managerial practices, as well as recruitment policies, a company-level survey is commonly recognised as more useful, while establishment-level managers may be more familiar with the everyday work and the skill requirements of production.

71. While most questions can be conceptually answered both at the enterprise or establishment level, the skill mismatch question in the Employer Module's questionnaire was rephrased to fit equally well at the enterprise level and at the establishment level. With the exception of countries developing stand-alone surveys, the choice of unit of observation is determined by the host survey. For the European CVTS, enterprises are the units of observation.

72. *Reference period.* While the host survey has its own reference period, selected items in the Module can refer to different or longer periods in the past. The reference period for the Employer Module is allowed to vary across countries to a certain extent, in order to accommodate differences across host surveys (if applicable) or in the timing of administration. For the first round of the Employer Module, data for European countries using the CVTS as a host survey will refer to the year 2020 as a baseline.

73. *Size-sector coverage.* The scope of the Employer Module is potentially vast: it can encompass firms in the private, public and non-profit sector, as is the case for workers surveyed by the PIAAC household questionnaire. All class sizes and industries are of potential interest. Contrary to the PIAAC household questionnaire, however, the Module is not suitable to cover the

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<sup>10</sup> "Enterprise" is the preferred term in the European CVTS framework. Enterprises are defined in Council Regulation (EEC) No 696/93 as "[...] the smallest combination of legal units that is an organisational unit producing goods or services, which benefits from a certain degree of autonomy in decision-making, especially for the allocation of its current resources. An enterprise carries out one or more activities at one or more locations. An enterprise may be a sole legal unit."



independent self-employed, who have different degree of autonomy than employees in deciding job tasks and skill set, and in engaging in training activities.

74. Once again, the choice of the host survey is determinant for the Employer Module, in terms of specifications for industry and size-classes and for the minimum number of surveyed units per sampling. These parameters are fundamental to ensure cross-country comparability, and to minimise the level of noise affecting the collected information. The CVTS, for instance, restricts the sample to private firms with at least 10 employees, operating in 20 specific 2-digit industries. The extent to which this is a constraint on the population of employers varies across countries. In many Southern European, a large share of enterprises has fewer than ten employees, although they often account for a relatively small share of aggregate employment.

#### Box 4.1. The first wave of the PIAAC Employer Module

The first wave of the PIAAC Employer Module went into the field in 2021-2022, with 2020 as a reference year. It saw the participation of a first batch of 5 European countries: Hungary, Italy, the Netherlands, Portugal, and the Slovak Republic. All countries had concluded the data collection by September 2022.

The Module was administered as an add-on to the 2020 wave of the European Continuing Vocational Training Survey (CVTS 6), an enterprise-level survey. The CVTS is a viable host for the Module for European countries, as the two questionnaires are partly overlapping and partly complementary. The many useful items on training provision and the strategic goals of enterprises that are collected in the CVTS work well in conjunction with the Module's core on skill gaps and strategies to address them. The pros and cons of using CVTS as vehicle for the OECD employer module were discussed in detail at the CVTS workshop in December 2018.

The administered questionnaire for the Module contained “core” and “essential”, questions, as well as the “desirable” items on training strategies (items QB1 to QB4, 5Annex A), which are included in the official CVTS questionnaire. Each participating country expanded the Module's questionnaire with other “desirable” questions, according to the country's policy priorities.

Using the CVTS as a host survey determined several parameters for the Module's data collection, including the unit of observation (legal units), the main reference period (2020), the coverage in sectors (NACE Rev. 2 categories B, C, D, E, F, G, H, I, J, K, L, M, N, R, S), and firm type (private firms) and size (10 employed persons or more).

The collected data for the Employer Module are transmitted to the OECD. The dataset includes: (i) the items currently covered by the Employer Module questionnaire, (ii) a country code, reference year and company identifier, (iii) the sampling weights, and (iv) the metadata.

Given that the current data collection for the Employer Module has not submitted the household questionnaire to the employees of the surveyed firms (*employer-employee approach*), data from the current wave of the Module will only be linked with PIAAC information at the intermediate level.

## Data and metadata reporting

### Data features and transmission

75. The data collected by the PIAAC Employer Module is expected to result in an international database. It is envisaged that the database contains firm-level responses to the Employer Module

questionnaire and the corresponding sampling weights, for all participating countries. In light of the pervasiveness of firm differences in capabilities, strategies, structure and performance even within narrowly defined industries, exploiting firm-level responses allows for a more granular and accurate representation of skill gaps in the economy, and their linkages to firm training or human resource strategies.

76. *Data cleaning and validation.* The collected data undergo a process of cleaning and validation at the national level, ahead of delivery to the OECD. The OECD supports countries in these operations, ensuring that such interventions yield comparable outcomes across countries or signalling possible misalignments in the final Technical Report. A second validation on the received data is performed by the OECD based on the international dataset, drawing cross-country statistics and check the validity of the constructs.

77. *Statistical confidentiality.* Statistical confidentiality (ensuring that the use of the data for statistical purposes does not result in the disclosure of information on an individual business entity) is achieved by anonymising the employer identifier and – where necessary – manipulating other elements of the microdata, via generalisation, data swapping, or perturbation.<sup>11</sup> This takes place at the country level, ahead of transferring the survey's data to the OECD. The choice of the applied disturbance must strike a balance between sufficient anonymisation and the usefulness of the perturbed data, and is coordinated across countries by the OECD.

78. *Secure data transfer and storage.* Once the data are made confidential, they can be transferred to the OECD for processing and analysis. Participating countries may already have a regulatory framework that enables the transfer of the Module's microdata to the OECD. In some cases, this transfer is subject to certain necessary conditions, such as the production of a scientific-use file. In the absence of such a framework, the OECD and the participating country can decide to sign an ad-hoc legal document (e.g., a Memorandum of Understanding), stipulating the conditions for the secure transfer, storage and use of the data.

79. The anonymised data of the Employer Module's that are sent directly by participating countries to the OECD are securely transferred via an OECD tried transfer facility, and then stored on a secure server at the OECD premises in Paris, France.

### **Metadata**

80. Countries administering the Module are requested to compile a metadata document that contains information on how the data were collected and processed, and in particular: survey design, unit of observation, target population, sampling frame and sample size, mode, timing and issues of the data collection, coverage, imputation principles and weighting, and a quality report.

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<sup>11</sup> *Generalisation* requires excluding certain information from the dataset, or reducing the granularity of the data, to make it less identifiable. Data could be changed into a range of values within selected logical boundaries. An example of generalisation is the transformation of a continuous variable for firm size (number of employed persons or turnover) into a size category. Censoring of variables falls within this category, as well. *Data swapping* (or permutation) rearranges the content of the variable so that they do not match the initial information. Switching year and day in a date of birth, for instance, qualifies as data swapping. Lastly, *data perturbation* adds random noise or applies rounding methods to the value of a certain variable.

# 5 Conclusions

81. Employer skill needs are constantly changing as firms engage in innovation, company reorganisation and restructuring, and enter or exit the market. This in turn results in new skill needs, skill obsolescence and skill imbalances. For these reasons, the role of employer strategies and practices in shaping both skill requirements and skills mismatches is a valuable area of research. High quality and internationally comparable data on skill gaps, however, are scarce.

82. This paper presented the rationale for developing an OECD employer survey on skill gaps (the PIAAC Employer Module), that can expand the evidence base policymakers can leverage to design effective skills and training policies. The paper also described the implementation of the first wave of the Module, which was administered in five European countries between 2021 and 2022, as an addendum to the European Continuing Vocational Training Survey.

83. The administered Module is composed of a set of “core” questions and a number of “desirable” questions that countries could administer as an option. The “core” questionnaire measures the pervasiveness of skill gaps across countries and their causes, especially in a context of technological transition. Other questions provide insights on firms’ policies about hiring, workforce training, and human resource management. Each of these firm practices can shape the dynamics of skill mismatches in firms, and the paper reviewed the stock of existing empirical evidence on those relationships.

84. The paper further discussed the policy and analytical rationale for linking information on skill gaps collected through the PIAAC Household Survey and the PIAAC Employer Module. On the one hand, a conceptual linkage between the two surveys is possible, as both collect information on skills use, work organisation and training. Using the same item scales and phrasing in both the Module’s “core” and the PIAAC Household Questionnaire (2<sup>nd</sup> wave) strengthens the conceptual link. On the other hand, a statistical linkage allows for richer and more insightful empirical analyses that move beyond the comparison of possibly differing assessments on skill gaps between employees and managers or employers. A link at the intermediate level can be obtained by aggregating information from PIAAC and the Module at the industry and firm size, which are meaningful dimensions in the analysis of skills demands and imbalances. A link at the individual level allows for a direct connection between the policies undertaken by employers and some dimensions of employees’ skills (e.g., skill proficiency or skill use).

85. The paper concluded with a review of some key aspects of the survey, including: the conceptual development of the questionnaire, the order of questions and their translation; the survey’s units of observation and coverage; and the mode of administration, and the requirements for data cleaning, validation and sharing with the OECD.

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# Annex A. Employer Module Questionnaire

## SECTION 1A: Core questions on skill gaps

**Q1. Thinking about the skills of people employed in your enterprise and the skills needed to do their current job, how many do you think do not have the skills needed to do their job to the required level?**

- a) All
- b) Most
- c) Some
- d) Few
- e) None
- f) Don't know

**Q2. Thinking about people employed who do not have the skills needed to do their job to the required level, which of the following do you think would need improving? (Tick the most important 3)**

	Skill area	[if Q1 = (a) to (d)]
<b>A</b>	General IT skills	
<b>B</b>	IT professional skills	
<b>C</b>	Management skills	
<b>D</b>	Team working skills	
<b>E</b>	Customer handling skills	
<b>F</b>	Office administration skills	
<b>G</b>	Foreign language skills	
<b>H</b>	Technical, practical or job specific skills	
<b>I</b>	Oral or written communication skills	
<b>J</b>	Mathematics or calculating skills	
<b>K</b>	Reading skills	
<b>L</b>	Problem solving skills	
<b>M</b>	Other	

**Q3. Further thinking about the persons you employ who do not have the skills needed to perform their job to the required level, which of the following actions are you taking to alleviate this situation? (Tick the most important 3)**

		[if Q1 = (a) to (d)]
<b>A</b>	Provide training	
<b>B</b>	Offer internal job mobility	

<b>C</b>	Recruit new staff with suitable qualifications, skills and competencies	
<b>D</b>	Recruit new staff combined with specific training	
<b>E</b>	Implement mentoring / buddying scheme	
<b>F</b>	Increase performance monitoring	
<b>G</b>	Provide feedback to staff	
<b>H</b>	Change work practices	
<b>I</b>	Reallocate work	
<b>J</b>	Automate production	
<b>K</b>	Implement domestic or foreign outsourcing	
<b>L</b>	Abandon the activity	

Note: Outsourcing in option (k) should be understood as transactions to either affiliated or unaffiliated (arm’s length) parties. Foreign outsourcing can therefore also include offshoring.

**Q4. In the last three years, was your enterprise significantly affected by any of the following changes? (Yes/No/I do not know answers, tick all that apply)**

		Yes	No	I don’t know
<b>A</b>	Changes to machinery			
<b>B</b>	Changes to information and communication technologies and processes			
<b>C</b>	Changes to working methods and organisational practices			
<b>D</b>	Changes in domestic outsourcing practices			
<b>E</b>	Changes in foreign outsourcing practices			
<b>F</b>	Changes in products or services			
<b>G</b>	Changes to the amount of contact you have with clients or customers			

Note: Outsourcing in options (d) and (e) should be understood as transactions to either affiliated or unaffiliated (arm’s length) parties. Foreign outsourcing can therefore also include offshoring.

**Q5. Was any training provided to support the employed persons through these changes? [if Q4= Yes at least once]**

- a) No, no training was needed
- b) No, but training was needed
- c) Yes, to everyone who needed it
- d) Yes, but only to some staff, because of resource constraints
- e) Yes, but only to some staff, due to other reasons

%%%%%%%%%

**SECTION 1B: Core questions on the company’s background**

**Q6. What is the postal code of this enterprise? If your enterprise consists of several local units, please consider the most important one.**

**Q7. What was the principal economic activity of your enterprise in 20XX?**

Note: Show list of NACE rev. 2 sectors (2-digit)

**Q8. What was the total number of persons employed by the enterprise at 31.12.20XX?**

**Q9. In 20XX, has the number of people working at your enterprise ...**

- a) Increased
- b) Decreased
- c) Stayed more or less the same

Note: (c) should be chosen if the change ranges from -5% to +5% approximately.

**Q10. In what year was your enterprise created?**

%%%%%%%%%

**SECTION 2A: Optional questions to the Module’s core**

**QA1. Is the fact that some of your staff do not have the skills needed to do their job to the required level causing your enterprise any of the following? (Yes/No answers, tick all that apply) [if Q1 = (a) to (d)]**

		Yes	No
<b>A</b>	Not able to take on as much business as you would like		
<b>B</b>	Loss of business or orders to competitors		
<b>C</b>	Delays in developing new products or services		
<b>D</b>	Difficulty in meeting quality standards		
<b>E</b>	Increased operating costs		
<b>F</b>	Difficulty in introducing new working practices		
<b>G</b>	Increased workload for other staff		
<b>H</b>	Difficulties in meeting customer service objectives		
<b>i</b>	The withdrawal of certain products or services altogether		
<b>J</b>	Difficulties in introducing technological change		

**QA2. Compared to others in your sector of economic activity how often does your enterprise lead the way in terms of developing new products, services or techniques?**

- a) Very frequently
- b) Frequently
- c) Occasionally
- d) Rarely
- e) Very rarely

**QA3. Where would you place your enterprise on the following scales? 1 indicates that this enterprise competes in a market for a standard or basic quality product or service, and 5 that you compete in a market for premium quality products or services.**

Standard or basic quality	1	2	3	4	5	Premium quality
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**QA4. Is this establishment...**

- a) The only establishment in the organisation
- b) One of a number of establishments within a larger organisation

Note: Question to be asked only if the survey is administered at the establishment level.

**QA5. Are the headquarters of your organisation based in this country or outside?**

- a) Within the country
- b) Outside the country
- c) Don't know

Note: Question to be asked only if QA4=(b)

%%%

**SECTION 2B: Desirable questions on firm practices: training <sup>12</sup>**

**QB1. Does your enterprise regularly assess the future needs of skills and competences in the enterprise?**

- a) No
- b) Yes but not regularly (mainly linked to changes in personnel)
- c) Yes, it is part of the overall planning process in the enterprise

Note: “regularly” refers to whether, over the past few years or going forward, your organisation carried out or plans to carry out the exercise more than once and on a systematic basis.

**QB2. In your enterprise, what are the ways through which employed staff became skilled at their jobs in 20XX? (Yes/No answers, please tick all that apply).**

- a) Participation in CVT courses
- b) Participation in guided-on-the-job training
- c) Participation in job rotation, exchanges, secondments or study visits
- d) Participation in conferences/workshops
- e) Participation in learning or quality circles
- f) Participation in self-directed learning/e-learning

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<sup>12</sup> “CVT” stands for “continuing vocational training”, “IVT” for initial vocational training. They could be replaced with “training” and “initial education” respectively.

**QB3. In 20XX, how many persons employed by the enterprise participated in one or more CVT course (either internal or external)? Open answer.**

Note 1: This refers to CVT courses only. Each person should be counted only ONCE, irrespective of the number of CVT courses the person has participated in.

Note 2: External CVT courses are principally designed and managed by organisations which are not part of the enterprise itself. It is important that the responsibility for the content of the course lies outside the enterprise.

**QB4. What were the reasons not to provide training for persons employed in 20XX? (Yes/No answers, please tick all that apply)**

		Yes	No
<b>A</b>	The existing qualifications, skills and competences of the persons employed were appropriate to the current needs of the enterprise.		
<b>B</b>	The preferred strategy of the enterprise was to recruit individuals with the required qualifications, skills and competences.		
<b>C</b>	Difficulties in assessing training needs in the enterprise.		
<b>D</b>	Lack of suitable offers of CVT courses in the market.		
<b>E</b>	High costs of CVT courses.		
<b>F</b>	Higher focus on IVT provision than on CVT.		
<b>G</b>	Major efforts in CVT made in recent years.		
<b>H</b>	High workload and no time available for staff to participate in CVT.		
<b>I</b>	Other reasons		

%%%

**SECTION 2C: Desirable questions on firm practices: HR and work organisation**

**QC1. Does the person in charge of human resources report directly to the head of this enterprise?**

- a) Yes
- b) No
- c) Not relevant (no person in charge of human resources at this enterprise)

**QC2. In this enterprise, thinking about work organisation:**

- a) What percentage of employees work in teams, where the members jointly decide how work is done?
- b) What percentage of employees is involved in groups who meet regularly to think about improvements that could be made within this workplace?
- c) What percentage of employees regularly up-date databases that document good work practices or lessons learned?

%%%

## SECTION 2D: Desirable questions on firm practices: talent recruitment

### QD1. Has your enterprise recently encountered any difficulties in...

		Yes, because applicants did not have the required skills	Yes, because there have been few or no applicants	Yes, for other reason	No	Does not apply
<b>A</b>	...recruiting employees for jobs which normally require a formal vocational qualification					
<b>b</b>	... recruiting employees for jobs which normally require a university degree					
<b>C</b>	... recruiting employees for jobs that do not require any formal qualification nor degree					

### QD2. Has your enterprise recently encountered any difficulties in retaining employees?

- a) Yes
- b) No

### QD3. Thinking about recent recruitments, did you experience difficulties finding candidates who possessed the skills needed to do their job to the required level?

- a) No, it was not difficult to find candidates with the required skills
- b) Yes
- c) It does not apply / There were no recent recruitments

### QD4. Thinking of the difficulties you experienced finding candidates who possessed the skills needed to do their job to the required level, what skills were the most difficult to find in candidates for recruitment? (Tick the most important 3)

	Skill area	[if QD3 = (b)]
<b>A</b>	General IT skills	
<b>B</b>	IT professional skills	
<b>C</b>	Management skills	
<b>D</b>	Team working skills	
<b>E</b>	Customer handling skills	
<b>F</b>	Office administration skills	
<b>G</b>	Foreign language skills	

<b>H</b>	Technical, practical or job specific skills	
<b>I</b>	Oral or written communication skills	
<b>J</b>	Mathematics or calculating skills	
<b>K</b>	Reading skills	
<b>L</b>	Problem solving skills	
<b>M</b>	Other	

**QD5. Which of the following are the main reasons why it is difficult to recruit and/or retain staff? (Tick all that apply)**

- a) Wages are lower than in other organisations
- b) Geographic location
- c) Unattractive conditions of employment
- d) Lack of career progression
- e) Long/unsocial hours
- f) High competition from other employers
- g) Not enough people interested in doing this type of work
- h) Staff don't want long term commitment
- i) Other

%%%%%%%%%

**SECTION 2E: Desirable questions on the firm's structure and business model**

**QE1. Are your products or services primarily sold...**

- a) Locally – within an individual town or local area
- b) Regionally – within a specific area of the country
- c) Nationally
- d) Internationally

**QE2. Approximately what is the structure of your workforce? Please indicate the percentage of the people in each category:**

- 1. Blue collar
- 2. White collar
  - a. Managers
  - b. Professionals
  - c. Commercials
  - d. Clericals
- 3. Proportion of temporary employment
- 4. Proportion of self-employed collaborators
- 5. Proportion of workers who are 50 or older?

## Annex B. Correspondence between PIAAC household – employer questionnaires

Table B.1. Questions with strict content reference across surveys

Employer Module Questionnaire	PIAAC Household Questionnaire
<p><b>Q1. Thinking about the skills of people employed in your enterprise and the skills needed to do their current job, how many do you think do not have the skills needed to do their job to the required level?</b></p> <p>a) All b) Most c) Some d) Few e) None f) Don't know</p>	<p><b>Q19a, section H: Overall, which of the following statements best describes your skills in relation to what is required to do your job?</b></p> <p>a) My skills are higher than required by my job b) My skills are matched to what is required by my job c) Some of my skills are lower than what is required by my job and need to be further developed d) Don't know</p>
<p><b>Q2. Thinking about people employed who do not have the skills needed to do their job to the required level, which of the following do you think would need improving? (Tick the most important 3) [if Q1 = (a) to (d)]</b></p> <p>a) General IT skills b) IT professional skills c) Management skills d) Team working skills e) Customer handling skills f) Office administration skills g) Foreign language skills h) Technical, practical or job specific skills i) Oral or written communication skills j) Mathematics or calculating skills k) Reading skills l) Other</p> <p>Note: the same categories are found in <b>QD4: Thinking of the difficulties you experienced finding candidates who possessed the skills needed to do their job to the required level, what skills were the most difficult to find in candidates for recruitment? (Tick the most important 3)</b></p>	<p><b>Q19b, section H: Which skills were you thinking of when you answered this question? Please name all that apply.</b></p> <p>a) Computer or software skills b) Skills in operating machinery/equipment c) Project management or organizational skills d) Team-working or leadership skills e) Skills in handling customers/clients, patients or students f) Communication and presentation skills g) Foreign language skills h) Reading and writing skills i) Skills involving numbers, calculating skills j) Other skills k) Don't know</p> <p>Note: the same categories are found in Q10, section B: What was the MAIN focus of this training activity?</p>
<p><b>Q4. In the last three years, was your enterprise significantly affected by any of the following changes? (Yes/No/I do not know answers, tick all that apply)</b></p> <p>a) Changes to machinery b) Changes to ICT technologies and processes c) Changes to working methods and organisational practices d) Changes in domestic outsourcing practices e) Changes in foreign outsourcing practices f) Changes in products or services g) Changes to the amount of contact you have with clients or customers</p>	<p><b>Q18a, section H: In the last three years, has your working environment significantly changed in any of the following areas? Mark all that apply.</b></p> <p>a) Machinery b) Information and communication technologies c) Working methods and practices d) Outsourcing and relocation practices e) Products or services f) The amount of contact you have with clients or customers g) None of the above changes h) Don't know</p>



<p><b>Q5. Was any training provided to support the employed persons through these changes? [if Q4=Yes at least once]</b></p> <ul style="list-style-type: none"> <li>f) No, no training was needed</li> <li>g) No, but training was needed</li> <li>h) Yes, to everyone who needed it</li> <li>i) Yes, but only to some staff, because of resource constraints</li> <li>j) Yes, but only to some staff, due to other reasons</li> </ul>	<p><b>Q18b, section H: Were any of these changes supported by training activities paid for by your employer?</b></p> <ul style="list-style-type: none"> <li>a) I received training for all the changes</li> <li>b) I did not receive any training</li> <li>c) Don't know</li> </ul>
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Note: The numbering of questions for the Household Questionnaire refer to the latest reference document (June 2020).

**Table B.2. Questions with looser content connection across surveys**

Employer Module Questionnaire	PIAAC Household Questionnaire
<p><b>QC2. In this enterprise, thinking about work organisation:</b></p> <ul style="list-style-type: none"> <li>a) What % of employees work in teams, where the members jointly decide how work is done?</li> <li>b) What % of employees is involved in groups who meet regularly to think about improvements that could be made within this workplace?</li> <li>c) What % of employees regularly up-date databases that document good work practices or lessons learned?</li> </ul>	<p><b>D09, section H: How often does your current job involve:</b></p> <ul style="list-style-type: none"> <li>- learning new things?</li> <li>- learning-by-doing from the tasks you perform?</li> <li>- keeping up to date with new products or services?</li> </ul> <ul style="list-style-type: none"> <li>a) Never</li> <li>b) Less than once a month</li> <li>c) Less than once a week but at least once a month</li> <li>d) At least once a week but not every day</li> <li>e) Every day</li> <li>f) Don't know</li> </ul> <p><b>D10, section H: How often does your current job usually involve helping your co-workers to learn new things?</b></p> <ul style="list-style-type: none"> <li>a) Never</li> <li>b) Less than once a month</li> <li>c) Less than once a week but at least once a month</li> <li>d) At least once a week but not every day</li> <li>e) Every day</li> <li>f) Don't know</li> </ul> <p><b>D14a, section H: Are you involved in improving the work organisation or work processes of your department?</b></p> <ul style="list-style-type: none"> <li>a) Always</li> <li>b) Most of the times</li> <li>c) Sometimes</li> <li>d) Rarely</li> <li>e) Never</li> <li>f) Don't know</li> </ul>
<p><b>QB2. In your enterprise, what are the ways through which employed staff became skilled at their jobs in 20XX? (Yes/No answers, please tick all that apply).</b></p> <ul style="list-style-type: none"> <li>a) Participation in CVT courses</li> <li>b) Participation in guided-on-the-job training</li> <li>c) Participation in job rotation, exchanges, secondments or study visits</li> <li>d) Participation in conferences/workshops</li> <li>e) Participation in learning or quality circles</li> <li>f) Participation in self-directed learning/e-learning</li> </ul> <p><b>QB3. In 20XX, how many persons employed by the enterprise participated in one or more CVT course (either internal or external)? [Open answer]</b></p>	<p><b>Q08a, section B: During the last 12 months, that is since ^MonthYear, have you participated in any training activity? Include any training activity even if it lasted for only one hour.</b></p>

Note: The numbering of questions for the Household Questionnaire refer to the latest reference document (June 2020).

## Annex C. List of international experts participating to the questionnaire design

Gilles Bérubé – Canada Human Resources and Skills Development;

Andries de Grip – Netherlands Research Centre for Education and the Labour Market (ROA).

Richard Garrett – UK Department for Education;

Nathalie Greenan – Centre d'études de l'emploi et du travail (CEET) ;

Michael Horrigan – United States Bureau of Labour Statistics;

Edward Lorenz – Université de Nice GREDEG;

Fabio Roma and Michela Bastianelli – Italy ANPAL (National Agency for Active Labour Market Policies);

Mantas Sekmokas and Jan Varchola – European Commission DG Employment;

Johnny Sung – Singapore Institute of Adult Learning;

Other participants to the group include:

Sabine Gagel – EUROSTAT; Dario Guarascio and Simona Mineo – National Institute for the Analysis of Public Policies (INAPP Italy); Ivan Neville – Labour Market Research and Analysis unit at the Australian Department of Education, Skills and Employment; and Oliver Shaw – UK Department of Education.