European Network of Public Employment Services
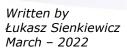
Future skills, career guidance and lifelong learning in PES

Thematic paper

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF BOXES

EXECUTIVE SUMMARY

This paper was written in the context of the PES Network Seminar on 'Future skills, career guidance and lifelong learning', held online on 9 February 2022, with the aim of assisting Public Employment Services (PES) to further develop their support for future skills through identifying methods for analysing skills needs and promoting lifelong learning. EU policy emphasises **skills as key for sustainable competitiveness, resilience and ensuring social fairness**. This is vital for the European Skills Agenda, focused on lifelong learning (upskilling and reskilling) investments for sustainable recovery after the coronavirus pandemic, and coping with the challenges of digitalising the world of work and greening the economy. With these changes already taking place and accelerating, Europeans will need to acquire new skills sets or improve their existing skills to adapt and thrive in the future labour market. Therefore one of the key actions under the European Skills Agenda is strengthening skills intelligence in European countries, in which PES play a vital role.

This paper contributes to the work of the PES Network, which in recent years has published surveys and organised mutual-learning events on skills forecasting, how to deal with skill shortages and up- and reskilling. It is based on a review of existing sources, as well as the **findings of the questionnaire sent to European PES in summer 2021**. This thematic paper presents an overview of how skills intelligence is organised in PES in Europe, including: overview of the approach to future skills intelligence; governance of PES skills-intelligence systems; overview of methodologies used by PES for skills intelligence; use of outputs from future skills assessments; and key barriers and challenges for skills intelligence. It also includes examples of good and promising PES practices presenting different approaches to skills intelligence, their development and rationale for adoption.

Analysis of approaches and practices in the area of future skills-needs intelligence revealed such activities **exist in the majority of PES**, but their scope, aim and advancement level are varied. A vast number of PES combine short- and long-term analyses, using different data sources and methodologies. Some countries have a systematic approach towards long-term requirements, while others undertake separate studies and activities aimed at analysing selected aspects of skills demand and supply. It should be noted that for some countries it is an ongoing process, as they are extending existing systems towards more advanced analytical methods (including AI, or web-scraping of job vacancies), a more robust methodological mix, broadening cooperation with stakeholders or development of new skills taxonomies. These changes are most often linked to longer-term trends in the labour market (like digitalisation or greening) but have also been accelerated by the pandemic.

Most PES use a mix of methods, including descriptive statistics, skills and jobs surveys, qualitative research and foresight methods. Quantitative forecasting is less common, and only few have adopted AI/big-data analysis. Studies of skills supply and demand are performed at different frequencies, most commonly on an annual basis; while the future skills analyses mostly cover a five-year period. The foresight methods often involve experts (through workshops and panels) as well as stakeholders (through interviews and surveys). The role of PES in skills-intelligence systems also varies. In some countries, PES do not play a central role, but support other responsible government bodies. Around half of the analysed PES have a specialised unit or department that is responsible for skills intelligence (design, analysis, reporting, etc.). Even when PES do not have a capacity for skills intelligence, they play active roles in the system, supporting all phases of the process. This influences the use of skills-intelligence outputs that are disseminated internally and externally and used in defining and executing upskilling and reskilling programmes and in supporting career guidance as part of PES services.

Key success factors revealed through the study include having a sound methodological framework, application of a methodological mix and use of updated and relevant information on skills, preferably through a skills classification system. Organisational

aspects play a pivotal role, including human resources capacity, sustainable funding sources, dedicated management support, strategic focus and constant development, improvement and monitoring. Finally, cooperation with external stakeholders is a crucial aspect of successful skills intelligence. Functioning of skills-intelligence systems is hampered by a number of **barriers**, of which the most significant are a lack of qualified and experienced staff, inadequate ICT infrastructure, cost of analyses/system and regulatory framework (mostly data protection legislation).

1. BACKGROUND AND RATIONALE

1.1 Background to the thematic paper

Diagnosing current and future skills needs is an increasingly important part of employment policies, including PES activities. It needs to be part of both the education and labour market system and requires stronger coordination among involved institutions. This is because self-adjustment mechanisms in the labour market are limited by a number of barriers, first of all the information barrier (information asymmetry), resulting in mutual lack of knowledge about labour market expectations among stakeholders and participants. Skills needs and expectations are dynamic over time, due to changes taking place in the economy, e.g. related to technological, social or economic factors.

The ability to diagnose current and future skills expectations in the labour market becomes a key factor in avoiding significant risks related to skills mismatch. It is also a prerequisite for future economic development. Matching processes, especially on the supply side, are usually long-lasting, and their effectiveness depends on the accuracy and usefulness of skills intelligence and forecasting mechanisms. Hence, more and more countries are turning to the development of tools and – more broadly – systems of skills intelligence. Developing tools and systems to better anticipate and match skills to the needs of the labour market is also an important part of the European Skills Agenda for Sustainable Competitiveness, Social Fairness and Resilience (Box 1).

Box 1: European Skills Agenda Action 2 – Strengthening skills intelligence

> **Labour market information systems (LMIS)** provide an essential basis for employment and labour policies, and inform the design, implementation, monitoring and evaluation of policies that are better focused and targeted. LMIS also contribute to a reduction in the transaction costs of labour markets as they help overcome incomplete information of labour market agents. (Source: ILO)
>
> **Skills intelligence** is the outcome of an expert-driven process of identifying, analysing, synthesising and presenting quantitative and/or qualitative skills and labour market information. This may be drawn from multiple sources and adjusted to the needs of different users. (Source: Cedefop)
>
> **Lifelong learning** encompasses all learning activities undertaken throughout life with the aim of improving knowledge, skills and competences, within personal, civic, social or employment-related perspectives. The intention or aim to learn is the critical point that distinguishes these activities from non-learning activities, such as cultural or sporting activities. (Source: European Commission)

Source: Communication on a European Skills Agenda for sustainable competitiveness, social fairness and resilience

The role of PES has evolved greatly and they now have a key role in identifying present and future skills and skills needs. PES are themselves increasingly involved in career guidance and brokers for and key providers of training. At the same time the context in which PES are operating is changing, notably due to the transition to a greener and more digital economy and tightening labour markets in various sectors. Skills are also high on the European agenda. One of the targets adopted under the European Pillar of Social Rights

is to have 60% of all adults participating in training by 2030. The role of PES is also quite prominent in some of the initiatives of the European Skills Agenda, as well as recent proposals for Council Recommendations on individual learning accounts and on micro credentials.

1.2 Aim of the thematic paper

In line with the objectives of the European Skills Agenda, the aim of this paper is to assist PES in further developing support for future skills through identifying methods of analysing skills needs and supporting lifelong learning. In recent years, the PES Network has published surveys and organised mutual-learning events on skills forecasting, how to deal with skills shortages and up- and reskilling. These studies revealed that European countries organise skills intelligence processes at the PES level differently and with varying degrees of effectiveness. Skills forecasting mechanisms, evidence-based guidance services and well connected up-/reskilling systems should be elements of a complete approach to skills intelligence. However, there are relatively few sources allowing a comparative assessment. The knowledge base on these systems needed to be amplified in order to formulate recommendations on how to support the needs for future skills.

In this context, this paper makes an important contribution through the questionnaire sent to PES as part of the preparatory work for the PES Network Seminar on 'Future skills, career guidance and lifelong learning'. It aimed to examine different aspects of PES approaches to providing skills intelligence and supporting development of skills needed in the future, as well as to capture lessons and good practices from experiences so far. The questionnaire was sent to PES and responses were received from 27 PES (AT, BE-Actiris, BE-Le Forem, BE-VDAB, BG, CY, DE, DK, EE, EL, ES, FI, FR, HR, HU, IE, IS, LT, LU, LV, NL, NO, PL, PT, SE, SI, SK).

Box 2: Key definitions

> **Labour market information systems (LMIS)** provide an essential basis for employment and labour policies, and inform the design, implementation, monitoring and evaluation of policies that are better focused and targeted. LMIS also contribute to a reduction in the transaction costs of labour markets as they help overcome incomplete information of labour market agents. (Source: ILO)
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This thematic paper was prepared in the context of the 2022 Network Seminar of the European Network of PES, held online on 9 February, which provided participants with the opportunity to explore the role of PES in the systematic collection of skills intelligence. The seminar featured practical examples of innovative ways of identifying skills amongst jobseekers and comparing them to the demand for skills in the labour market. Those examples showed how to make use of data and artificial intelligence (AI) while ensuring that the findings meet the needs of potential users.

1.3 Structure of the thematic paper

This thematic paper presents a structured and condensed overview of how skills intelligence is organised in PES, including the following aspects:

- Overview of the approach to future skills intelligence;
- Governance of PES skills intelligence systems;
- Overview of methodologies used by PES for skills intelligence;
- Use of outputs from future skills assessments.

This overview is based on available sources, complemented by the PES questionnaire inputs. It includes examples of good and promising PES practices presenting different approaches to skills intelligence, their development and rationale for adoption. This paper concludes by presenting key lessons learned and conclusions based on the overview, the practices and the analyses.

2. ANALYSIS OF PES APPROACHES AND PRACTICES IN THE AREA OF FUTURE SKILLS INTELLIGENCE

As noted in the European Skills Agenda, the first step to making sure people can acquire the skills they need for a current or future job is up-to-date information on skills needs. Therefore, accessible, easily understandable, targeted and up-to-date skills intelligence is necessary. An OECD report[1] notes that public intervention can help address skills mismatches in the labour market but depends on good data on current and future skills needs. This, in turn, depends on the design of the skills-intelligence systems and their implementation. Therefore approaches to skills intelligence can be diverse, reflecting the specific context and employing different methodological perspectives.

The differences in the existing systems for diagnosing the need for skills concern[2]:

- the method of approximating the demand for skills (focusing on the direct measurement of specific skills or the use of approximations in the form of indirect measures, e.g. levels of qualifications or occupations);
- the adopted time perspective (short-, medium- or long-term needs);
- methods of diagnosis (one or more; quantitative and qualitative);
- the scope of the diagnosis (national, regional or sectoral approaches).

According to the authors of the OECD report, the **most common approaches are medium-term vocation-level forecasts or current skills-needs diagnosis** based on labour market data or job vacancy analysis. Long-term forecasting presents the authors with a number of challenges related not only to the availability of data, but most of all to the complexity of macro-scale processes, especially in a globalised world. This requires a comprehensive approach to forecasting, taking into account a number of perspectives and conditions not only of an economic, but also social, legal and political nature. For this reason, apart from the need to involve employers in the long-term forecasting process, experts from other fields and areas of science and economy should also be involved. Therefore, it is necessary to analyse in more detail the current PES approaches to future skills intelligence.

2.1 Overview of the general approach to future skills intelligence in PES

Surveyed PES reported on the state-of-play of future skills intelligence in their respective labour markets (Table 1).

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[1] OECD (2016), Getting Skills Right: Assessing and Anticipating Changing Skill Needs, OECD Publishing, Paris.

[2] OECD (2016), Getting Skills Right: Assessing and Anticipating Changing Skill Needs, OECD Publishing, Paris.

Table 1: State of play of PES approaches to analysing future skills requirements in the labour market

State of play	No. of PES	Country/PES
PES currently analysing future skills needs	18	AT, BE-Actiris, BE-Forem, BE-VDAB, CY, DE, EE, ES, FI, FR, HR, IE, LT, LU, NL, NO, PT, SE, SI, SK
PES setting up a new system for future skills analysis	8	BE-VDAB, EL, ES, IS, LU, LV, PT, SI,
PES has neither analysed future skills needs nor has plans to start	3	BG, DK, PL

Source: Own data on the basis of PES survey.

According to the questionnaire results, **18 PES currently analyse future skills needs**. Another eight report setting up a new system, and three – a minority of PES - have neither analysed existing future skills needs nor plan to develop a system to do so[3]. The rationale for this is the lack of appropriate methodical tools, existence of other (occupation-based) studies, different division of responsibilities with non-PES bodies responsible for research and skills analyses, and lack of capacity for in-house skills intelligence. However, among the countries that undertake analyses, the rationale and motivation for setting up specific systems vary.

2.1.1 Existing skills-intelligence systems

A number of PES combine short- and long-term focused analyses, using different data sources and methodologies. Also the advancement levels and aims, and the corresponding approaches, differ between PES. For example in **SI,** bi-annual employment forecasting among employers with the focus on future needs is performed, coupled with an annual Occupational Barometer prepared for 177 occupation groups. In **ES**, SEPE's Occupations Observatory performs annual surveys of technical and professional skills and cross-cutting skills by occupation, based on quantitative and qualitative information along with analysis of skills required by companies in their online job offers. **LT** Employment Service conducts surveys of employers once a year. Employers are asked for one-year forecasts regarding the changes in their activities affecting employees by profession, changes in investment that drive demand for skills, and other factors determining hiring needs. In addition, the Employment Opportunity Barometer, based on an annual survey of employers and experts' opinions, forecasts employment opportunities for 155 occupations. In **NO**, every second year NAV makes a Horizon scan which discusses the most important societal trends that will affect labour and welfare until 2035 and the potential consequences these may have, including future skills needs.

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[3] It should be noted that in countries like DK, BG or PL, PES undertake a number of activities aimed at analysing skills and occupational needs. As the information in tables and boxes is based on questionnaire responses by PES, some of them do not report having a systematic approach, especially in relation to future skills or skills intelligence, as defined above. Also in some countries PES do not perform skills analyses themselves (as described later on in the text) and use inputs, data and reports from other responsible government institutions or bodies. Therefore, these countries reported on the state-of-the-art in their countries, and answers reflect their approach to separate actions/projects rather than skills-intelligence systems as a whole.

Box 3: Analysis of skills needs in France

The analysis of skills needs is mainly based on the skills listed in the job offers posted by recruiters. Specific surveys are also undertaken in order to determine the skills needs in a particular field (e.g. focus on Ecological Transition in 2021). These surveys are carried out through the Labour Force Needs Survey (Enquête de Besoins de Main d'œuvre BMO). Each year, Pôle emploi sends a questionnaire to 1.9 million companies in order to find out their recruitment needs by sector of activity and by labour pool. This survey provides essential knowledge about the labour market. It helps anticipate recruitment difficulties, improves the orientation of job-seekers towards training courses and informs job-seekers about developments in the labour market.

Source: PES survey.

The **AT** PES is providing further education for people who are seeking employment as well as employees, so the analyses of future skills are performed to fulfil the needs of the labour market for skills, competences and qualifications. **BE-Actiris** does not prepare specific analysis of future skills, but different thematic reports and analyses include future needs, with the focus on recruitment difficulties and the needs of the Brussels labour market. In contrast, **BE-VDAB** has been gathering extensive data on skills – covering both job-seekers and vacancies – for a few years, using different analytical techniques including AI development and applications. As most of the data focus on the current state of the labour market, an AI-experiment, 'Competrend', focusing on predicting skills needed for vacancies, has been undertaken. Together with the partners within the government as well as the universities, this is due to be expanded to combine the data with predictions on job-seekers, as well as sectoral evolutions.

Box 4: Using data and AI to determine skills trends in Belgian VDAB

VDAB (Flanders PES in Belgium) is using the Skills Framework to determine current and future skills trends. The VDAB Skills Framework is driven by the language of citizens, i.e. the language employers and job-seekers use in vacancies and CVs or other textual data related to employment. It consists of four components or steps: the Skill Cloud, Skill Tagger, Skill Navigator and the Skill Seeker.

The four components of the VDAB Skills Framework

Skill Cloud Mapping from skill-expressions to standardised forms	**Skill Tagger** Detection of Skill Cloud skill-expressions and annotation with standardised forms
Skill Navigator For any piece of text, decide which Skill Cloud skills are similar to it	**Skill Seeker** Detection of new skills

The first step - **Skill Cloud** - measures and visualises the association between different expressions. The Skill Cloud links textual expressions based on semantic and linguistic relations and defines the standardised forms using a scoring mechanism in graph components of the linked data to detect the dominant form.

The **Skill Tagger** reduces a text to a basic form by removing HTML tags and special characters etc. The Tagger then searches for known Skill Cloud expressions and

annotates them with their standardised form. For example, in the textual expression 'We expect you to be a true team player' it will recognise the word group 'team player' as a known skill expression and will annotate the given text with its standardised form, in this case 'working in a team'.

The **Skill Navigator** can tell the user for any given text (e.g. job description or function title), which known skills are close to it, even when these skills or their known Skill Cloud forms do not appear literally in the text. Technically, it does so by mapping known skills and the given text to a 72-dimensional numeric space. Subsequently the distance between such coordinates can be computed.

Finally, the **Skill Seeker** identifies skills that did not surface in step 1 (the Skill Cloud). It does so by looking for positions (text parts) in a text where skills can be expected to appear (based on the Skill Tagger annotation process) and then verifies whether these text parts contain expressions that are not known by the Skill Cloud. This provides a list of a candidate's new skills that could be added to the Skill Cloud, which is manually validated to guarantee the quality.

Source: Presentation of VDAB, the Flanders PES in Belgium, at the 2022 PES Network Seminar on 'Future skills, career guidance and lifelong learning', 9 February 2022.

2.1.2 Development of existing or setting up of a new system

Some countries report developing existing systems, including use of more advanced analytical methods or combinations thereof, inclusion of new technologies, cooperation with new stakeholders, or adoption of new classifications (like ESCO). For example, in **BE-Le Forem**, in 2021, methodology changes have been introduced to update the previous exercise of future-looking analyses dating back to 2018. For many countries, the practice of future-needs analysis is long-standing. However, traditionally, these future-facing analyses or forecasts have been performed on the basis of occupational demands rather than skills demands (e.g. in **SE**, **PL**). Several countries report that the PES is setting up a new system for future skills analysis. For example in **LU**, ADEM has launched the Future Skills Initiative in 2020, which includes a pillar on skills intelligence. In **IS**, skills intelligence and forecasting is a new project in the Icelandic labour market. Statistics Iceland is to perform long-term skills forecasts and the Directorate of Labour will carry out assessments regarding short-term skills needs.

Box 5: Development of new skills-analysis system in Greek PES (OAED)

Within the framework of Greek PES efforts to strengthen a data-driven and evidence-based approach, there is a strong need to enhance the use of sophisticated tools such as the Labour Market Diagnosis Mechanism developed by E.I.E.A.D[4], while at the same time expanding and embedding its functions in a way that enables the PES to enhance its performance in regard to ALMP delivery, and especially the matching process. The LMD Mechanism is expected to lead to a targeted decision-making model as it facilitates the analysis of labour market needs. It can also be used as a diagnosis and a forecasting tool through which cutting-edge functionalities can be obtained. This includes capacity for skills-needs analysis, based on ILO's categorisation of skills levels. The Labour Market Needs Diagnosis Mechanism collects, processes, analyses and visualises data into a special information system. The data sources are ELSTAT (Hellenistic Statistical Authority), ERGANI (the Ministry of Labour's private employment database), OAED and ESCO. The use of the ESCO Tool is expected to strengthen the skills-based approach.

Source: PES survey.

In some countries PES do not play a central role in analysing skills requirements but instead support other government bodies responsible for these activities. For example, the **CY** PES

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[4] See National Institute of Labour and Human Resources

role is as a catalyst in assisting the Human Resource Development Authority (HRDA) of Cyprus to collect important information and trends regarding future skills needs. This is achieved through the daily interaction of PES counsellors with employers and vacancies when referring candidates to specific job posts. In **FI**, the PES acts together with other public employment and education policy actors, analysing future skills needs, and adjusting the need for public employment services as well as training opportunities for the unemployed job-seekers accordingly.

Box 6: Skills intelligence in Ireland

While the Department of Social Protection (DSP) has overall responsibility for the PES, SOLAS is the State agency responsible for the Further Education and Training (FET) sector. Skills-needs analysis is carried out across a range of platforms, with multiple partners across Ireland. This includes bespoke research and analysis completed by the Expert Group on Future Skills Needs, work completed by SOLAS, partly through the skills and labour market research unit, which is a component of the SOLAS Transformation Directorate, and future skills forecasting more generally across further education and training and in areas including apprenticeship. In addition to this, a wider skills infrastructure is in place which incorporates the National Skills Council, the Labour Market Council and other related forums and groups, such as the National Training Fund Advisory Group and the Technology Skills 2020 High Level Group. Other agencies and organisations are also involved in future skills-needs analysis including Skillnet Ireland, IDA Ireland[5], with a number of linked initiatives across the wider skills landscape which engage wider stakeholders.

Source: PES survey.

For many countries the key rationale is provision of key PES services, helping people (both job-seekers and inactive) into employment. In other cases, PES also undertake skills forecasting to achieve broader aims in up- and reskilling, often in close cooperation with educational institutions and other stakeholders. In doing so, PES usually act on behalf of the ministry responsible for labour (**SK**). However, the skills forecasts are often used more widely, e.g. in the area of development of educational/study programmes at regional level and to make recommendations for educational enrolment policy (**HR**). In this sense, the PES uses future-looking exercises to be proactive and provide preventive support (**LV**).

Even when a PES plays an important or central role in skills analyses, it often uses other sources coming from institutions responsible for labour market and education analysis. This is the case in **DE**, where the findings and reports of the relevant research institutions (BIBB, IAB, etc.) on future developments in the labour market are used for individual career guidance. At the same time, DE PES also incorporates regional data (e.g. from chambers, associations, network partners), to assess the current situation on the VET and CVET market and the individual support options of those seeking guidance. The **EE** PES uses the results of labour-demand surveys on sectoral needs for labour and skills (OSKA[6]), conducted by the Estonian Qualifications Authority. OSKA analyses the needs for labour and skills necessary for Estonia's economic development over the next 10 years.

PES shared the changes that have been introduced recently or are planned as the result of future skills intelligence (Table 2).

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[5] See Industrial Development Agency

[6] See OSKA

Table 2: Changes introduced as a result of future skills intelligence

Changes introduced recently	1. Changes implemented recently		2. Changes being planned		3. No changes	
	No. of PES	Country/PES	No. of PES	Country/PES	No. of PES	Country/PES
Changes to skill sets due to pandemic (short-term)	5	BE-Actiris, BE-Forem, EE, EL, SK	3	BE-VDAB, PT, SI	11	AT, BG, DE, DK, FI, HR, IS, LT, LU, FR, SE
Changes due to digitalisation (long-term)	8	AT, BE-Forem, DE, EE, ES, FI, FR, LU	9	AT, BE-Actiris, BE-VDAB, IS, LV, PT, SE, SI, SK	4	BG, DK, HR, LT
Budgetary cuts due to the crisis	1	SK	1	DE	14	AT, BE-Actiris, BE-Forem, BE-VDAB, BG, DK, FI, FR, HR, LT, LU, PT, SE, SI
Changes due to economy greening	3	BE-Forem, DE, EL	7	AT, BE-Actiris, BE-VDAB, EE, FR, LU, SK	8	BG, DK, FI, HR, LT, PT, SE, SI

Source: Own data on the basis of PES survey.

Out of the changes implemented by PES recently, the **most common are changes due to digitalisation** (long-term), introduced by eight organisations. Nine PES plan to implement such changes in the near future. Only four do not plan to do so. The second most pressing priority is changes to skill sets due to the pandemic (short-term). Five PES have implemented such changes recently, three plan to do so, and 11 do not envisage such developments. Also some PES (three) introduced changes due to economy greening, with a further seven planning to do so in the near future. All of these changes are motivated by the need to adapt to changes in the labour market and skills needs observed in recent years around Europe. Only budgetary cuts due to the crisis have not caused significant changes in skills-intelligence systems, as only one organisation reports such developments, and one plans changes in the near future.

Box 7: Changes in skills intelligence due to digitalisation in PES

In **DE,** digital offerings in the area of schools as well as in vocational education and training are being used more intensively and, according to current estimates, will be further expanded in the future. Career guidance services must be adapted accordingly. For example, digitisation and ecological transformation are constantly being incorporated into the revision of occupational requirements and competencies. Own occupational clusters or competence clusters make evaluations possible, e.g. in 'environmental occupations'. Occupations and new competencies, especially in the area of digitisation, are an important trend in the ongoing updating of occupational data.

In **EE,** the pandemic has amplified the importance of raising people's digital skills. Changes during the crisis period have led to an increase in the share of distance learning and the need to adjust the conditions of the acquired training, to offer more distance learning. Since 1 January 2021, the PES has expanded the opportunities for employers to apply for training support for the development of employees' ICT skills. The COVID-19 impact study on labour force and skills needs, conducted by the Estonian Qualifications Authority, provides an overview of which digital skills needs are growing in different areas of the economy and what ICT skills are worth teaching employees.

In **FI,** as services are digitalised, they will be further digitalised as understanding of the future digital skills needs increases both in the PES work in regional offices as well as in the services provided for unemployed job-seekers.

In **FR**, a new full-distance training market launched during the crisis with an objective of 45,000 entries in 2020 and 2021.

In **PT**, there were changes in working methods and customer relationship management formats (incorporating more and more digital solutions) and also some concern with adapting internal training to the new skill-sets requirements. These changes did not come from internal future skills-intelligence exercises, but from pandemic-related evidence and external research.

Source: PES survey.

2.2 Skills assessment and anticipation methods used in PES

Skills-intelligence systems can employ a number of skills assessment and anticipation tools, as presented in Table 3.

Table 3: Classification of skills assessment and anticipation tools by Cedefop

Type of activity	Description
Descriptive statistics/stock taking	Estimates of overall demand and supply of skills and technology use, often based on collating data from various sources (for example sector skill studies)
Quantitative forecasting	Forecasting and projecting future demand for skills typically using econometric modelling
Skills and jobs surveys (questionnaire surveys)	Assessments of demand and supply of skills and technology use, usually with an assessment of the extent to which demand and supply are balanced
Graduate tracer studies	Using matched administrative datasets or surveys to track people through education and the labour market to see how the former influences the latter
Qualitative research	Use of non-quantitative techniques to gauge in-depth information about current and future skill demand/supply and technology trends, e.g. via company case studies, use of focus groups
Foresight	Critical thinking about the future of skills supply/demand and technology trends using participatory methodologies
Big data	Use of web sourcing combined with text mining and machine learning approaches to collect and classify data about skills, vacancies, technologies

Source: Cedefop (2021). *Understanding technological change and skill needs: skills surveys and skills forecasting. Cedefop practical guide 1*. Luxembourg: Publications Office.

The adoption of each of these methods (or their combination) should be rationalised on the basis of needs and understanding of methodological constraints. In particular[7]:

- **Surveys and other primary data collection** methods should be used when there is a relatively well-developed understanding of the technologies and associated skills of interest. Surveys will tend to provide information on the use of skills and technologies, extent to which skills are available, efforts taken to fulfil skill needs, etc.

- **Skills forecasting** should be used where time series data are available on skill needs (based on qualification and occupation), and where there is an underlying macroeconomic model that can provide robust estimates of future employment demand by sector, skills forecasts can provide quantitative projections of future skill demand (circa 10 years ahead).

- **Big-data analysis** is particularly useful where views about the future may not be well developed: where there is uncertainty about either the types of technology that

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[7] Source: Cedefop (2021). *Understanding technological change and skill needs: skills surveys and skills forecasting. Cedefop practical guide 1*. Luxembourg: Publications Office.

are likely to become dominant or commonplace, and/or the skills associated with those technologies. It can also offer the detailed level of analysis that forecasting and surveys struggle to provide.

- **Technology forecasting** should be adopted where there is a large amount of information that needs synthesising to develop actions to ensure that skills needs, associated with particular technologies, can be met, or where there is limited data and expert groups can address the lack of information.

Surveyed PES reported on the skills assessment and anticipation tools being currently used in their organisations (Table 4).

Table 4: Skills assessment and anticipation tools used in PES

Method/tool	No of PES	Country/PES
Descriptive statistics/stock taking	23	BE-Forem, BE-VDAB, CY, DE, DK, EE, EL, ES, FI, FR, HU, IE, IS, LT, LU, LV, NL, NO, PL, PT, SE, SI, SK
Quantitative forecasting	10	BE-Actiris, BE-VDAB, DE, EL, ES, HU, IE, LV, NL, SE
Skills and jobs surveys (questionnaire surveys)	15	BE-Forem, BG, DK, EL, ES, FI, FR, HU, IE, LT, LV, NL, NO, SE, SI
Graduate tracer studies	9	BE-Actiris, BE-VDAB, DE, ES, HR, HU, IE, NL, SE,
Qualitative research (including qualitative forecasting)	13	AT, BE-Actiris, BE-Forem, CY, DE, EE, ES, FI, IE, LV, PL, SE, SI
Foresight	12	AT, BE-VDAB, CY, DE, ES, HU, IE, LU, LV, NL, PT, SE
Big data	9	AT, BE-VDAB, DK, ES, FI, IE, LU, NL, SE

Source: Own data on the basis of PES survey.

Descriptive statistics and/or stock-taking of skills are the most widespread tools used in European PES (23 PES), followed by skills and jobs surveys (15 PES), qualitative research (13) and foresight methods (12). Less common are quantitative forecasting (used by 10 PES), graduate tracer studies (9) and methods based on big-data analysis (9).

Some PES use combinations of different methods. For example, **DE** uses descriptive statistics/stocktaking in form of IAB job survey, digitisation and change in employment (DiWaBe), and personal survey; quantitative forecasting in form of Qualification and Occupation in the Future (QUBE); tracer studies for graduates in form of survey data from the National Education Panel (NEPS); qualitative research (including qualitative forecasting) in form of database for vocational training and job descriptions; big data in form of job-data research 'Kompetenzkompass' (completed), as well as further projects currently planned. In **FI**, skills assessment and anticipation of future skills, different methods for data gathering and analysing the data are used. In the short term, more quantitative methods are applied, whereas in longer-term anticipation, more qualitative methods are used. The **IE** skills-needs identification system also uses a combination of datasets, as this can provide insights that allow for the identification of current and potential future skills needs and shortages. This combined approach is also the case in **DK**, **BE-VDAB**, **ES**, **NL**, **FR**.

Box 8: Combining qualitative and quantitative inputs in the German Forecast

In the German forecast up to 2030, a digitalisation scenario was developed, based on qualitative in-depth studies on specific aspects of digitalisation and automation. Besides the baseline scenario, an accelerated digitalisation scenario was developed to assess the impact of increasing digitalisation in the labour market. The qualitative studies provided necessary inputs for altering assumptions within the macroeconomic model at the sectoral level, leading to changes in demand for occupation and skills within sectors.

In many instances, lack of historical data on the effects of changes had to be overcome by including information from the qualitative studies. The qualitative information had to be translated into quantitative estimates that could feed into the macroeconomic model, i.e. sector-based employment effects, and into changes in the occupation and/or qualification effects of digitalisation. Some of these were ad hoc and expert-based, while others could be grounded more in the information the qualitative studies provided.

Source: Cedefop (2021). *Understanding technological change and skill needs: skills surveys and skills forecasting. Cedefop practical guide 1*. Luxembourg: Publications Office.

Among other methods used in PES for skills assessment and anticipation the survey revealed:

- Text analysis and machine-learning models to identify and categorise skills (**DK**);
- Analysis of registered data from CVs database of formerly unemployed people (**NL**);
- Labour shortages and surplus analysis (**PT**).

Box 9: System of skills analysis in Spain

The **Spanish Observatory** identifies occupations generating a positive trend. It then uses this information to create different survey units grouped by training criteria and economic activity. The Observatory's regional network uses individual interviews and expert round table discussions in different geographical and professional areas to collect the information. This is done on the basis of a structured questionnaire that aims to identify skills with training needs and those that are emerging or evolving — starting from an analysis of workers' professional profiles. Each year, the Observatory analyses and classifies the information and issues a report.

The Observatory also uses questionnaires and interviews with experts selected by profession and geographical area. These sector-specific surveys deepen the understanding of trends and prospects for sectors and economic activities with good employment creation potential or that are innovative business drivers. These surveys cover trends (employment, change factors, industry), business strategies, innovations (technology and organisation), and the occupational map of each sector, the occupational structure and its quality, emerging occupations, etc. Also, analysis of each sector's training provision, the training needs of the occupations and the adequacy of the training offer to satisfy the needs is performed.

Profiles of the jobs on offer deepen the knowledge of the professional profiles and skills required by companies to fill their jobs. The Observatory's territorial network gathers information on the selected professional profiles from job offers published online with relevant content about the requirements requested by recruiters. It does this using a CRM to exploit offers posted on the SEPE's EMPLÉATE (Get Employed) website. This information gives it access to offers from different public and private websites and offers that businesses publish directly. ES is currently working with the EMPLÉATE website to incorporate text analysis methods and tools and machine learning to make it a source of relevant information for wider use in research and reports. The labour market for graduates is analysed through monitoring job-seekers registered with employment offices with recognised qualifications (university, vocational training, and professional aptitude certificate).

> The methods and products mentioned above are fed into tools for vocational support for job-seekers ('Set the Course of Your Professional Future, We're Here to Help You') and for staff guidance (Send@).

Source: PES survey.

Different classifications (including taxonomies/ontologies) are used in PES to link information on skills demands in the labour market (see Table 5).

Table 5: Classifications (taxonomies/ontologies) used in PES to link information sources on skills demands[8]

Classification/ taxonomy	No. of PES	Country/PES
ESCO	9	BE-VDAB, BG, DK, EL, FI, IE, LU, SI, SK
O*NET	1	IE
ISCO	18	AT, BE-Forem, BE-VDAB, BG, CY, DK, EE, EL, ES, FI, HU, IE, LT, NL, NO, PT, SI, SK
NACE	16	AT, BE-Actiris, BE-Forem, BE-VDAB, BG, EE, ES, HU, IE, LT, LU, LV, NL, PT, SI, SK
EQF/NQF	6	EE, EL, HU, IE, PT, SI

Source: Own data on the basis of PES survey.

PES in Europe often use more than one classification, which in the majority are complementary rather than coherent. While often national-level ISCO-based occupational classifications are aligned with ESCO, other classifications are rarely compatible (e.g. NACE or EQF) but still provide important information for the provision of PES services.

The most commonly used classification among PES is ISCO (used in 18 organisations), followed by NACE (16 PES). A significant number of the PES (9) studied started using ESCO as the reference classification. EQF/NQF classifications are less common, used by six PES. Only **IE** makes use of O*NET classification. Other classifications are commonly used by PES, including:

- National-level classifications that are linked to ISCO-08 classification by ILO (e.g.**,** FEOR-08 in **HU**, KZiS in **PL,** SSYK in **SE**, ΣΤΕΠ 92 in **EL)**;

- National-level classifications of occupations developed for internal purposes (e.g. Austrian taxonomy of occupations and competences in **AT**, Classifications of occupations KldB2020/DKZ in **DE**), which include specificities of the national labour markets, but are in line with international standards (e.g. DKZ is compatible with both ISCO and ESCO via available mapping tables);

- Some countries report working on ESCO adaptation and/or implementation (**HU**, **IS**, **PT**, **NL, CY**);

- Few countries report using ISCED (International Standard Classification of Education) classification for education levels and fields of learning (**IE**, **NL**, **EE**) or internal classifications in this area, like classification of educational/study programmes in **HR**;

- French-speaking communities report using ROME (Répertoire Opérationnel des métiers et des Emplois) classification, or their adaptations (**FR, BE-Actiris, BE-Le Forem, LU**). It is also used by **BE-VDAB.**

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[8] All job vacancies, applications and CVs publicly available through PES, EURES Members or EURES Partners must be made available on the EURES portal using the ESCO classification. Member States may choose to replace their national classifications with ESCO or map national classification systems to ESCO.

Box 10: Coordinating skills supply and demand in France using the ROME classification

To enable matching of skills supply and demand and furthering professional mobility, Pôle emploi developed a new approach to skills: ROME 4.0., an 'Operational Directory of Professions and Jobs'[9]. It was developed in cooperation with a large network of partners, including companies, branches and professional unions, and the national agency for adult vocational training - AFPA - and its associated companies. The objective of ROME is to have a 'language/approach to skills' shared by the main players in the French employment and training sector. ROME is based on an inventory of the most common job names/professions, analysis of activities and skills, and grouping of jobs according to a principle of equivalence or proximity. Version 4.0 includes a substantially further developed competency-based approach. Currently there are some 500 macro-competencies and 7,000 competencies listed that address the skills needed by companies, including both technical and soft skills and using ESCO as a basis. The approach is aligned with the one used for competence profiles in the framework of the individual training accounts platform[10], and thus closely linked to the needs of companies. While at the national level competencies and trainings tend to be more focused on anticipating the requirements of a digitalised world, green skills are promoted more by certain regions.

Source: French PES presentation at the 2022 PES Network Seminar on 'Future skills, career guidance and lifelong learning', 9 February 2022.

PES perform analyses of skills needs at varied frequencies (Table 6).

Table 6: Frequency of skills-needs analysis of the labour market

Type of analysis	Frequency	No. of PES	Country/PES
Supply of skills	Irregularly/ incidentally	7	BE-Actiris, CY, DK, EE, FR, HU, LT, LU
	Once a year	10	BE-Actiris, BE-Forem, CY, El, ES, IE, LT, NL, PL, PT, SI
	Twice a year	1	FI
	Quarterly	1	NL
	Monthly	5	BE-VDAB, IS, LV, NO, SE
Demand for skills	Irregularly/ incidentally	7	At, BE-Actiris, BE-Forem, DE, EE, HU, IS, LT, LU
	Once a year	9	BE-Actiris, EL, ES, FR, LT, NL, PL, PT, SI, SK
	Twice a year	4	BG, FI, SE, SI
	Quarterly	3	DK, IE, NL
	Monthly	4	BE-VDAB, LT, LV, NO
Other analyses	Irregularly/ incidentally	4	LV, NO, SE, SI
	Once a year	6	BE-Actiris, BE-VDAB, DE, HR, IE, NL, PL
	Twice a year	1	EE
	Quarterly	2	LV, NL
	Monthly	1	SE

Source: Own data on the basis of PES survey.

Most commonly, the supply of skills is analysed annually (10 PES), as is the demand for skills (9 PES). Supply is analysed more frequently is some countries, most often on a monthly basis (5 PES), rarely quarterly or bi-annually (1 PES each). In seven of the analysed PES supply of skills is performed irregularly, as is demand for skills (7 PES).

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[9] Répertoire Opérationnel des Métiers et Emplois.
[10] The Platform plays a key role in implementing the individual training accounts for which French workers build up entitlements in the course of their working lives.

Demand analyses are generally more diverse: in four PES they are prepared once a month, in four bi-annually, and in three on a quarterly basis. A significant share of PES also perform other analyses on a regular basis. These include:

- In **BE-Actiris**: annual analysis of recruitment difficulties in Brussels (Analyse des fonctions critiques); bi-annual graduate tracer study, needs for training and employment (Détermination des besoins en emploi et en formation), and language skills; irregular analyses of: COVID-19 impact, sector studies, consultation with employers.

- In **BE-VDAB**: continuous data analysis on skills of job-seekers and vacancy skills requirements, with structured analyses performed on monthly, annual or ad-hoc basis.

- In **DE**: annual review of job descriptions in BERUFENET system.

- In **DK**: annual or bi-annual update of the Competence Model.

- In **EE**: use of the results of labour-demand surveys of sectoral needs for labour and skills (OSKA) (irregularly) and Occupational barometer (twice a year).

- In **HR**: annual analysis of relative outflow to employment by educational/study programme using data on registered unemployment and relevant information from mediation counsellors.

- In **SE**: The most important forecasts and analyses are published twice a year. In addition, there are further analyses of, for example, the structure of unemployment, which illustrate the supply of labour/skills, published monthly (and partly weekly).

- In **SI**: Other analyses are occasional, focused on specific occupations or specific economic sectors that EES is currently interested in or where PES envisages there will be growth in future skills demand (e.g. ICT sector).

- In **SK**: Analyses of innovative requirements, especially with regard to skills in the intelligent industry, are also carried out through a separate national project 'Sector-driven Innovations for an Efficient Labour Market in the Slovak Republic', which is implemented with the support of the ESF.

Box 11: Long-term forecasting in Ireland

At SOLAS, some of the skills-demands indicators, such as the Recruitment Agency Survey and the survey of employer skills needs (at regional level) are carried out at other intervals (i.e. twice a year, and on an ongoing basis, respectively). Apprenticeship forecasting normally takes place for a three year period with an annual review. In Ireland, the new government 10-year strategy on literacy, numeracy and digital literacy includes significant research on existing skills levels and sets out the ambition for the future. Analysis currently completed to support future skills needs on a wider economic and social basis for further education and training initiatives, such as the Skills to Compete Initiative, leans heavily on the available data from Ireland's Central Statistics Office which published research based on labour force surveys etc. This is assessed across the broader landscape in terms of planning provision.

Source: PES survey.

Also timeframes (scope) of analyses vary (Table 7). **The most common timeframe for future skills analysis is up to five years**, with this approach implemented in 17 of surveyed PES. Some of the PES have longer forecasting timeframes – between 5-10 years (4 PES) and over 10 years (3 PES).

Table 7: Timeframe of future skills analysis

Timeframe for future skills analysis	No. of PES	Country/PES
Up to 5 years	17	AT, BE-Forem, BE-VDAB, BG, EL, ES, FI, FR, HU, IE, LT, LU, LV, NL, SE, SI, SK
Between 5-10 years	4	DE, EE, FI, HR
Over 10 years	3	DE, FI, NO

Source: Own data on the basis of PES survey.

Some other approaches include:

- ad-hoc or current needs-based analysis (**CY**);
- short-term analysis up to one year (**PL, PT**);
- short and medium term up to three years (**ES**);
- different for various projects – two and six years (**NL**).

In providing further-looking analyses, PES use a number of foresight methods (Table 8).

Table 8: Use of foresight methods for skills intelligence

Foresight method	No. of PES	Country/PES
Interviews and surveys with stakeholders	15	AT, BE-Actiris, BE-Forem, BE-VDAB, BG, DE, ES, FI, HU, IE, LT, LV, SE, SI, SK
Delphi method	3	BE-Forem, HU, PL
Design-thinking methods	1	BE-Forem
Experts' workshops / meetings / panels	18	AT, BE-Forem, BE-VDAB, BG, CY, DE, ES, FR, HU, IE, LT, LU, LV, NL, PL, SE, SI, SK
STEEP/STEEPV, PEST/PESTLE analysis	1	BE-Forem
SWOT analysis	6	AT, BE-Forem, BG, HU, IE, LV
Scenario development methods	3	BE-Actiris, BE-Forem, DE

Source: Own data on the basis of PES survey.

Out of the available **foresight (or future-looking) methods**, **the most commonly used are experts' workshops, meetings or panels** (18 PES), followed by interviews and surveys with stakeholders (15 PES). Somewhat popular is the SWOT analysis, used in six PES. Scenario development methods and Delphi methods are used in a minority (3) of PES. The least common are the design-thinking methods and STEEP/PEST analyses, performed only in one PES. In many cases the PES use more than one method, ensuring they fit into respective methodologies and assumptions. For example in **BE-Actiris** for 'Fonctions Critiques', 'Détermination des besoins' and a study on the impact of the COVID crisis on the sector of transport and logistics view.brussels used interviews with stakeholders as part of the methodology. For prospective analyses on the impact of the COVID crisis on the labour market in Brussels, view.brussels used scenario development methods.

PES also carry out other analyses. In **CY**, meetings with employers and other forms of direct communication (telephone or internet) are used to identify skills needs or problems with their availability. In **DE**, editorial analysis of job advertisements both in the Bundesagentur vacancy portal ('BA-Jobbörse') and on other search portals, company websites, daily newspapers, weekly newspapers, etc., is performed, which serves editorial updating of competence and qualification requirements in regulated occupations, in close

coordination with or on notification of amended vocational training regulations from BiBB[11] and chambers.

COVID-19 influenced the foresight pre-pandemic assumptions to some extent. Some PES evidenced more changes due to the pandemic, some of a temporary character and others more long-lasting.

In some cases, the pandemic influenced the implementation of existing methods, mostly by moving experts' workshops or panels online (**AT, PL, LT**), or other forms of virtual interaction (**CY**). In **LT**, the employer survey previously carried out in direct communication with stakeholders by filling in a written survey, due to the pandemic took place only remotely, actively inviting participants, sending reminders by e-mail and a link to the questionnaire. In **SI**, the spring 2020 survey was adjusted to the new epidemic reality: it was postponed for three months. As employers faced lock-down and thus great insecurity, some questions were added and focused on the new circumstances.

In some cases, changes are long-lasting and relate to observed developments in the labour market. In **ES**, the Observatory identified occupations as a way to match abilities with training needs and draw up professional profiles based on online job offers. In **DE**, the pandemic resulted in tighter schedules, more unregulated professions, more digitisation, and - since the beginning of 2020 – recording and reporting on digitisation trends for all professions. In countries where the new skills-intelligence system is being developed, the COVID-19 effects have been taken into account during the development process (**HU, LU**).

In practice, PES use a number of future skills determinants in their forward-looking methods (Table 9).

Table 9: Use of future skills determinants in forward-looking methods

Future skills determinant	No. of PES	Country/PES
Technological change (including digitalisation/automation, etc.)	16	AT, BE-Forem, BE-VDAB, DE, ES, FI, FR, HU, IE, IS, LT, LU, NL, PT, SE, SK
Environmental issues (including climate change, economy greening, etc.)	13	AT, BE-Forem, BE-VDAB, DE, ES, FI, FR, HU, IE, IS, NL, PT, SK
Demographic changes (including population ageing, generational changes, etc.)	13	AT, BE-Forem, BE-VDAB, DE, ES, FI, HU, IE, IS, NL, PT, SE, SK
Increasing inequalities (including exclusion of vulnerable groups, labour market polarisation, etc.)	7	AT, BE-VDAB, DE, ES, IS, PT, SK
Globalisation issues (including migration, global supply chains, etc.)	9	AT, BE-VDAB, DE, ES, FI, IE, IS, PT, SK
Changes in the world of work (including emergence of new forms of work, online/distance working and learning, etc.)	11	AT, BE-Forem, BE-VDAB, DE, ES, FI, IE, IS, NL, PT, SK

Source: Own data on the basis of PES survey.

The most commonly applied determinant in future-looking methods is technological change, including digitalisation, automation, etc. (used in 16 PES), followed by environmental issues (climate change, economic greening, etc.) and demographic changes (including population ageing, generational changes, etc.), which are both taken into account by 13 PES. Less common are the determinants related to changes in the world of work (including emergence of new forms of work, online working and learning, etc.) used by 11 PES, and globalisation issues (migration trends, global supply chains) in nine PES. The least common are determinants of increasing inequalities

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[11] See Bundesinstitut für Berufsbildung (Federal Institute for Vocational Education and Training).

(exclusion of vulnerable groups, labour market polarisation), which are being taken into account by seven PES. Other determinants and their use include:

- **EE**: future skills determinants are used in the designing process of services (for example to detect the appropriate target groups for services).
- **HR**: regional and local economic development plans/strategies.
- **LU**: regulatory changes (such as data protection, environmental or financial sector) and societal changes (changing customer demands, new business models).

PES use these determinants to complement analyses in different ways (Table 10).

Table 10: Ways in which determinants are used to complement analyses

Way determinant is used	No. of PES	Country/PES
By including them/ their impacts quantitatively in macroeconomic modelling (e.g. recalculating the model)	6	BE-VDAB, DE, HU, IE, NL, SE
By contextualising findings by including qualitative information (e.g. interpreting or explaining data)	16	AT, BE-Forem, BE-VDAB, DE, ES, FI, FR, HU, IE, LT, LU, NL, PL, PT, SE, SK
By preparing alternative future scenarios including probability/risks analysis, for which skills demand/supply is calculated	4	BE-Forem, DE, PT, SE

Source: Own data on the basis of PES survey.

The majority of PES (16) use these determinants to contextualise findings by including qualitative information, e.g. by interpreting or explaining data. In some cases (6), change drivers or their impacts are included quantitatively in macroeconomic modelling, e.g. by recalculating the model. For example, in **HR,** determinants and their impacts are included in relation to particular occupations in forecasts. In a minority (4) of PES, alternative future scenarios including probability and/or risk analysis are being prepared on the basis of determinants.

It is important to note that **current developments in big data and artificial intelligence create new perspectives for skills intelligence and skills-policy developments** (see Table 11). As noted in the European Skills Agenda, artificial intelligence and big-data analysis have a great potential in future skills intelligence. Cedefop, the European Commission, ETF, ILO, OECD and UNESCO[12] jointly make efforts to analyse potential and increase the use of big data and AI in skills policy developments. This approach allows for the combination of different data sources (online job advertisements, online CVs, web-scraped data relevant to skills, etc.) in order to enrich skills intelligence at the international and national levels. While prospective, this approach proves challenging in many ways (in strategic approach, resources needed, ethical and legal concerns, possible biases, representativeness, and need to analyse the contextual factors).

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[12] Cedefop; EC; ETF; ILO; OECD; UNESCO (2021). *Perspectives on policy and practice: tapping into the potential of big data for skills policy.* Luxembourg: Publications Office.

Table 11: Information potential of big-data analysis in skills policy

	Governments national/regional	Education and training providers	Employers	Individuals
Information potential	More real-time monitoring of labour market trends. More detailed and regionally adapted skills anticipation. Additional insight into what broader trends mean for skills demand and supply.	Faster insight into changes in professional practice. More insight into demand for occupations and skills in the regional context. Better understanding of regional skills supply and demand imbalances.	More real-time insight into emerging trends in occupations and skills. Additional insight into regional labour market situation. Better understanding of critical skills bottlenecks.	Better understanding of skills increasingly in demand. More contextually adapted (region/sector) labour market and skills intelligence. Increased understanding about labour market opportunities.
Policy/action potential	Stronger feedback loops. More proactive skills policy. More responsive up-/reskilling measures. More evidence-based competitiveness policy/strategy.	Increased capacity to respond to changing skills needs. More evidence-based programme offer. More effective and proactive careers information and guidance provision.	Increased capacity to map corporate skills needs. More evidence-informed recruitment policy. More forward-looking approach to training and development.	More informed education and training choices. More proactive approach to developing career and employability. More successful transitions between occupations.

Source: Cedefop; European Commission; ETF; ILO; OECD; UNESCO (2021).

In practice, more robust methods, including knowledge extraction tools are used by PES to a limited extent (Table 12).

Table 12: Use of automated knowledge extraction/analysis tools

Use of knowledge extraction/analysis tools	No. of PES	Country/PES
Any tools, including:	12	AT, BE-Forem, BE-VDAB, DE, DK, ES, FI, FR, IE, LU, NL, SE
Use of web scraping/web crawling to access and gather data	9	AT, BE-VDAB, DE, DK, ES, FI, IE, NL, SE
Analysis of textual data with the use of natural language processing (NLP) tools	8	BE-Forem, BE-VDAB, DE, DK, ES, FI, FR, LU
Using machine learning (ML) algorithms to extract and elaborate information	6	BE-VDAB, DE, DK, ES, FR, SE

Source: Own data on the basis of PES survey.

Twelve of the analysed PES use automated knowledge extraction/analysis tools. Out of them, nine use web scraping/web crawling to access and gather data, eight use analysis of contextual data with the use of natural language processing (NLP) tools, and six use machine learning (ML) algorithms to extract and elaborate information. In **DE**, application of knowledge extraction/analysis tools is not yet a standard process, but successfully tested in initial projects. In **IE**, the Skills and Labour Market Research Unit (SLMRU) of SOLAS uses the Cedefop skills OVATE data.

2.3 Governance of PES skills-intelligence systems

Creating a solid methodology for diagnosing the need for skills is a necessary, but not a sufficient condition for achieving an effective impact through public intervention. Collecting more and better data does not automatically lead to better skills-matching policies. As noted by K. Pouliakas[13], ensuring a feedback loop between the demand for skills and the education system is the result of a multi-dimensional, multi-layered and multi-stakeholder process. The lack of clarity is particularly acute in terms of roles and responsibilities between different ministries, departments and institutions, or a lack of trust between social partners. The ability to disseminate results and include them in the mainstream of politics is conditioned by the ability to coordinate activities, as well as involving end-users (e.g. social partners, representatives of the education sector, public employment services) in the process of developing assumptions and carrying out the diagnosis[14].

Box 12: Cedefop's skills governance stakeholder interviews

As part of **Cedefop's country support initiative** to improve EU Member States' skills anticipation and matching systems, stakeholder interviews were carried out in four EU countries (Bulgaria, Estonia, Greece and Slovakia) in 2017-18. The stakeholder interviews were based on a generic questionnaire which helped develop in-depth understanding about the key elements in Cedefop's skills governance analytical framework:

- **Regulatory framework**: the role of organisations in labour market and skills intelligence according to regulation, its practical implementation and suggested improvements;
- **Institutions:** stakeholder participation in LMSI, the functioning of bodies of exchange and relevance of external experts;
- **LMSI management:** collection of labour market information (organisations, organisation role, stakeholder involvement), own experience with stakeholder collaboration and evaluation, involvement in the interpretation of results, involvement in policy actions, difficulties in engaging with stakeholders, practical collaboration with agencies, conflict resolution;
- **LMSI tools/methods:** methods used in LMSI, suitability of data and methods, sufficiency of detail collected, suggestions for improvement;
- **LMSI dissemination:** obtaining LMSI information, targeting LMSI information, LMSI customisation, LMSI presentation and dissemination;
- **Sustainability and reputation**: confidence in the existing skills anticipation and matching system or practices, key limitations of existing systems, view on necessary future development, planned developments.

Source: Cedefop (2021). *Understanding technological change and skill needs: big data and artificial intelligence methods. Cedefop practical guide 3*. Luxembourg: Publications Office.

The process of organising skills-intelligence analysis varies among European PES. Fourteen of the surveyed PES (**BE-Le Forem, BE-VDAB, DE, DK, EL, ES, FR, HR, IE, IS, LT, LU, NL, SE**) that provided answers to the questionnaire have a **specialised PES unit/department that is responsible for skills intelligence** (design, analysis, reporting, etc.). Some of the examples include:

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[13] Pouliakas K., *Making labour market and skills intelligence policy relevant: How Cedefop supports countries,* 17 October 2017.

[14] European Commission, *Skills Governance in the EU Member States. Synthesis Report for the EEPO*, Directorate-General for Employment, Publications Office of the European Union, Luxembourg 2015.

- **BE-Le Forem**: Market Analysis Department in cooperation with service responsible for monitoring;
- **BE-VDAB**: Team planning in cooperation with Monitoring Department and AI team;
- **DE:** Department Media Management Education and Career (AM52);
- **DK**: Danish Agency for Labour Market and Recruitment;
- **EL**: EIEAD Expert for the Labour Market Mechanism – in collaboration with the PES Service for Statistics;
- **ES**: Occupations Observatory at the National Public Employment Service (SEPE), which reports to the Sub-Directorate-General for Statistics and Information;
- **FR**: Department of Statistics, Studies and Evaluation and Department of Skills;
- **HR**: The CES analysts at central and regional offices;
- **IS**: Data analysis department;
- **LT**: Monitoring and Analysis Division;
- **LU**: Future Skills Initiative team (in collaboration with statistics team and with employer services team);
- **NL**: Department of labour market information and advice.

The rest of the PES sample do not have a specialised unit or department that deals with skills intelligence or forecasting. In the case of some PES, this responsibility is vested in other organisational units within the employment service or the ministry responsible for labour, like:

- **AT**: Department of Labour Market Research and Career Information;
- **BE Actiris**: View.brussels – Actiris' study department;
- **BG**: Identification, analysis and prediction of skills for the labour market is a part of mediation services provided to job-seekers in employment offices;
- **LV**: Development and Client Service Division;
- **PL**: Labour Market Observatories and statistical or analytical units within regional labour offices analyse occupational demand;
- **PT**: Studies, Planning and Management Control Unit;
- **SI**: Skills forecasts are a part of the project of the EU Social Fund, supported by the Department of Analytics at the ESS Central Office;
- **SK**: The competence was delegated to the Ministry (Section of Informatics, Department of Employment Services Methodology) and to the Institute of Social Policy, which is an organisational part of the Ministry.

In other cases, PES use analyses prepared by other organisations, both governmental and non-governmental:

- **CY**: While the PES observatory collects data and prepares preliminary analysis, the detailed analysis, design and reporting is performed by HRDA (Human Resources Development Authority), which is a separate semi-governmental organisation;
- **EE**: The PES uses the results of labour demand surveys on sectoral needs for labour and skills (OSKA), conducted by the Estonian Qualifications Authority;
- **FI**: Ministry of Economic Affairs and Employment, Development and Administration Centre of TE Offices and ELY Centres (Regional agency for development and administration services, KEHA);
- **HU**: Ministry of Innovation and Technology is responsible for forecasting;
- **IE**: Skills intelligence is provided by government body – SOLAS.

Surveyed PES provided information on the division of roles in the skills-needs analysis process (Table 13).

Table 13: Division of roles in future skills-analysis process

Responsibility/participation scheme	No. of PES	Country/PES
Performed solely by PES (design, implementation, data collection & analysis prepared in-house)	9	BE-Forem, BE-VDAB, ES, FI, FR, HR, HU, LT, SI
Performed by PES with external support	9	AT, DE, FI, HU, LU, NL, PL, SE, SI
Active participation by PES with decisive powers (deciding on the scope, methodology, etc.)	4	ES, HU, IS, LU
Active participation by PES without decisive powers (data collection & analysis)	8	AT, BG, CY, EE, FI, HU, SI, SK
Passive participation by PES (use of skills-intelligence outcomes of activities performed by other bodies)	6	AT, DK, FI, HU, IE, NO
No participation or use of skills intelligence	3	BE-Actiris, LV, PT

Source: Own data on the basis of PES survey.

For a majority of PES (18) the skills-intelligence analyses are performed mostly in-house. In nine of these, responsibility for the whole process of skills analysis (design, implementation, data collection & analysis) is vested solely in the PES. The same share of PES (9) perform analysis in-house, but with external support. A significant group of PES (8) have an active participatory role, but without decisive powers (mostly data collection and analysis). In four PES, active participation is combined with decisive powers, where they decide on the scope, methodology, etc. Passive participation is reported by six PES, which mostly use skills-intelligence outcomes of activities performed by other bodies. More specifically, PES provided information on elements of the skills-intelligence process that are provided internally or externally (Table 14).

Table 14: Elements of the skills-intelligence process that are provided internally or externally

Element of the skills-intelligence process:	1. Provided in-house by PES staff	2. Provided externally by private research companies	3. Provided externally by public/academic research institutions	4. Provided externally by other specialised government bodies/agencies
	No. of PES	No. of PES	No. of PES	No. of PES
Design of methodology	12	4	5	6
Sampling	8	4	6	6
Fieldwork/data gathering	10	6	4	5
Analysis of gathered data	13	6	5	7
Reporting on the results for evidence-based policy	14	5	4	7

Source: Own data on the basis of PES survey.

The most common elements of the skills-intelligence process that are provided in-house by PES staff are: design of methodology (12 PES), fieldwork/data gathering (10), analysis of data (13) and reporting results (14). The least common is sampling (8). Support from private research companies is looked for most commonly in fieldwork (6) and analysis of data (6). Public and academic research institutions support PES in sampling (6), design of methodology (5) and analysis of data (5). Other specialised government bodies often support all elements of the process, but most commonly analysis of data (7) and reporting results for evidence-based policy (7).

Box 13: Advantages of the multi-stakeholder coordinated skills-intelligence process in Ireland

A significant advantage of Ireland's skills-needs identification system is the collaboration and cooperation amongst a range of interested bodies involved in the supply and demand for skills in Ireland. For example the National Skills Council is made up of representatives of employers, a range of government departments and agencies (e.g. Department of Public Expenditure, PES/Department for Social Protection, Education and Business), and education/training providers. The work of the National Skills Councils is informed by three related groups:

1. SOLAS - the skills and labour market research unit;
2. The Expert Group on Future Skills Needs (horizon-scanning research at sectoral level);
3. Regional Skills Fora (a network of nine fora which, on behalf of the Department of Further & Higher Education, Research, Innovation and Science, work to help employers identify skills needs and, where relevant, connect with appropriate education providers to address those needs).

The strength of Ireland's skills-needs identification system lies in the interplay of each of these actors and the multi-departmental involvement at government level.

The key process of skills intelligence is provided by a government body – SOLAS. One of the advantages of a state body such as SOLAS supporting skills analysis is the development of a cost-effective, in-house resource on skill needs, which is readily accessible by policy-makers and relevant stakeholders (e.g., education/training, labour market activation). Research staff in SOLAS, as public-sector employees, have long tenure and vast experience, which allows them to build up knowledge and develop networks and reducing the cost of externally provided research. External cooperation is fostered through networks, including European networks, access to datasets (e.g. by Cedefop ReferNet), and engagement with other agencies like the OECD.

Source: PES survey.

In some countries the whole process is developed and operated internally. In **BE-VDAB**, since data on skills are collected internally and there are two engaged departments (labour market studies and an AI team), the organisation has the necessary skills to process all the data on skills itself. However, if third parties are interested in the data, they can be made available on request regardless of the type of organisation (e.g. universities, private companies or other government agencies). In **ES**, all of the elements (methodology, sampling, fieldwork, analysis and information on results) are carried out by SEPE's personnel assigned to the Occupations Observatory. The team responsible for each survey draws up precise methodologies and the necessary instructions for executing each of the phases of the established processes in co-ordination with the Observatory's Central Unit.

Box 14: Collaboration of the Dutch PES with research institutions in determining current and future skills needs

The Dutch PES (UWV) uses several partnerships with various institutions for projects that develop skills intelligence with the aim of providing valid, reliable, specific, targeted and up-to-date labour market indicators. Parties interested in this information include counsellors, policy-makers, and press, but also individual job-seekers, employers and students. Partner organisations comprise the national statistics office, universities, research institutes, and a company specialised in artificial intelligence.

Linking PES administrative data to information from the Labour Force Survey made it possible to assess the actual availability of job-seekers for work. This analysis amongst others showed that only 10% of welfare recipients and one third of unemployment benefit recipients are unemployed according to the LFS criteria.

> In another project, a company specialised in artificial intelligence searches for vacancies through web spidering. A research company supports UWV in assuring the representativeness of the findings by upscaling and weighing the data. These are then used to measure tensions in the labour market by occupational group and region.
>
> A third partnership aims at sophisticated medium-term forecasting by the Research Centre for Education and the Labour Market (ROA), associated with the University of Maastricht. It involves a long-term cooperation with four ministries, S-BB (Cooperation between vocational education and industry organisations), Randstad (a temporary work agency), and four institutes that contribute in kind. The forecasting is done six years ahead by econometric modelling and thematic studies. The modelling takes into account expansion demand, replacement demand, substitution demand, and inflow of a new supply of workers. It provides forecasts for 114 occupational groups and 103 types of study.
>
> Another project focuses on the production of reliable labour market information for graduates of different education levels and detailed types of studies. The PES has formed a partnership to this end with SEO, an economic research company linked to the University of Amsterdam and with CBS/Statistics Netherlands, the national statistics bureau. These three institutions have clearly defined distinguishable roles in this project.

Source: UVW (Dutch PES) presentation at the 2022 PES Network Seminar on 'Future skills, career guidance and lifelong learning', 9 February 2022.

Many PES believe that their organisation should play an active role in development and implementation of skills-intelligence analyses. As noted by **AT,** 'the design of methodology is based and coordinated within the PES because the questions for the research are raised by the organisation itself, by our stakeholders and/or social partners'. In **DE**, the external service provider compiles descriptions of over 3,000 occupations, job opportunities and fields of study for the BA, which plays a strategic role in the process. In **FI**, the skills-intelligence process is internal in terms of professions and skills needed in the short- and long-term future. However, the PES also uses external research and information in assessing future skills needs, and orders studies and surveys from research institutions. Furthermore, the PES actively participates in the skills-intelligence work of the Finnish National Agency for Education. In **FR**, skills intelligence is mainly provided in-house at Pôle emploi, but in close cooperation with other government services. The sampling, data gathering, analysis of gathered data and reporting are undertaken internally, but the design is the responsibility of other directorates, including those in charge of the delivery of services for job-seekers and companies.

2.4 Use of outputs from future skills assessments

The skills challenges are common to many policy areas and therefore information on future skills demand and supply could potentially be used in the formulation of various public interventions. However, it is mainly used in employment and educational policy. According to the authors of the OECD report[15], information on skills needs is widely used in employment policy to update occupational standards and to design apprenticeship programmes, retraining courses and on-the-job training programmes. In educational policy, this information is commonly used to develop core curricula, determine the number of places in educational institutions (at all levels of education), or provide educational and vocational guidance for students.

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[15] OECD (2016), Getting Skills Right: Assessing and Anticipating Changing Skill Needs, OECD Publishing, Paris.

Box 15: OECD Skills Profiling Tool

The OECD developed a Skills Profiling Tool to help training, employment and career guidance counsellors assess people's abilities and offer better guidance. The OECD tool assesses technical skills, literacy and numeracy, digital skills, and a set of transversal skills. Users can compare their resulting skills profile with the profile of others, such as all citizens of a country, or groupings of people by education level, age group, and different occupations. The systems also suggests possible occupations that match their profile. The tool was piloted in December 2021. Career guidance counsellors (38) from PES in Chile, Colombia, Mexico, and Peru used the tool with 270 career guidance users. The pilot showed that it took 15-30 minutes to complete the questionnaire, and that the tool helped to better understand the profile of the career guidance user, especially for users without a clear career path. Counsellors do need to adapt the recommendations for users to the local labour market, as the tool is designed to be universally applicable. The tool is currently available in Spanish, English and Portuguese and is free of charge. To access the tool visit the [dedicated website](#).

Source: OECD presentation at the 2022 PES Network Seminar on 'Future skills, career guidance and lifelong learning', 9 February 2022.

In the survey, PES shared information on what outputs of skills-intelligence analysis or research findings are available internally and externally (Table 15).

Table 15: Availability of skills-intelligence findings internally/externally

Use of outputs	Internally		Externally	
	No. of PES	Country/PES	No. of PES	Country/PES
Executive summaries of findings	13	AT, BE-Forem, CY, DE, ES, FI, HU, IE, LT, NL, SE, SI, SK	15	AT, BG, CY, DE, EE, FI, HU, IE, IS, LT, NL, PL, SE, SI, SK
General reports presenting key findings	16	AT, BE-Actiris, BE-VDAB, BG, CY, DE, FI, HU, IE, LT, LU, NL, PL, SE, SI, SK	18	AT, BE-Actiris, BE-Forem, CY, DE, EE, EL, ES, FI, HU, IE, IS, LT, NL, PL, SE, SI, SK
Detailed analyses comprising all research questions/ problems	11	AT, BE-VDAB, BG, DE, FR, HU, IE, LU, NL, SI, SK	10	AT, BE-Forem, BG, DE, EE, ES, FI, FR, IE, SK
Specific analyses and evaluations focused on separate problems/target groups of clients	15	AT, BE-Actiris, BE-Forem, BE-VDAB, BG, DE, FR, HU, IE, LU, NL, PL, SE, SI, SK	10	AT, BE-Actiris, BG, CY, DE, EE, ES, FI, FR, SE
Datasets for open access/use	10	BE-Actiris, BE-Forem, BE-VDAB, BG, DE, DK, NL, PL, SE, SK	9	BE-VDAB, BG, DE, ES, HU, NL, PL, SE, SI

Source: Own data on the basis of PES survey.

Findings from skills assessments are mostly available internally through general reports presenting key findings (16 PES), and specific analyses and evaluations focused on separate problems and/or target groups of clients (15). Less available are executive summaries of findings (13 PES), while the least common are detailed analyses comprising all research questions/problems (11) and datasets for open-access use (10).

The situation is similar with information available externally, with the most common use of general reports with key findings (18 PES) and executive summaries of findings (15), followed by detailed and specific analyses. In some PES (9), information is provided externally online as open-access data (e.g. in **BE-Actiris** the website 'Viewstat' with labour market indicators). Outputs of skills assessments are disseminated in various ways among surveyed PES (Table 16), with a view to service design and/or improvement.

Table 16: Dissemination of skills-intelligence findings for service design/improvement

Dissemination of outputs	No. of PES	Country/PES
Handbooks/guidebooks/toolkits for staff	14	AT, BE-Forem, BG, DE, DK, EE, ES, FI, FR, LT, NL, PL, SE, SK
Handbooks/guidebooks/toolkits for customers (including job-seekers and employers)	11	AT, DE, DK, EE, ES, FI, FR, LT, SI, SE, SK
Guidance / information for external stakeholders (e.g. VET providers, other educational institutions)	16	AT, BE-Actiris, BE-Forem, BE-VDAB, DE, EL, ES, FI, FR, HR, HU, IE, NL, SE, SI, SK
Redefinition /re-design of ALMPs in line with changing skills requirements	12	AT, BE-Actiris, BE-VDAB, CY, DE, EE, FI, FR, HU, IS, SI, SK
Internal conferences/seminars for staff (including career guidance counsellors)	16	AT, BE-Actiris, BE-Forem, BE-VDAB, BG, CY, DE, EE, HU, IE, LV, NL, PL, SE, SI, SK
Internal training/peer-learning sessions (including career guidance counsellors)	11	BE-VDAB, BG, DE, EE, HR, HU, IE, LU, NL, SE, SK
Transformed into formal training content/ lifelong learning	10	AT, BE-VDAB, BG, DE, EE, LU. LV, SE, SI, SK

Source: Own data on the basis of PES survey.

As regards the **dissemination activities among PES staff**, skills-intelligence findings are usually presented at internal conferences or seminars for staff, including career guidance counsellors (16 PES). Also handbooks, guidebooks or toolkits for staff are widespread (14 PES). Less common are findings used for service design and improvement in the form of redefinition or re-design of ALMPs in line with changing skills requirements (12 PES) or internal training and peer-learning sessions, including for career guidance counsellors (11 PES). Least common is the transformation of outcomes into formal training or lifelong learning content (10 PES).

In terms of dissemination activities for **external stakeholders**, guidance and information for external stakeholders (e.g. VET providers, other educational institutions) is the most common (16 PES). Use of outputs creates interface for communication and exchange of opinions with partners (**CY**). Also in **NL** and **SI**, labour market information is appreciated by stakeholders, including employers and policy-makers. **BE-VDAB** notes high demand for skills intelligence at the level of policy-making. In **DE**, there is a frequent exchange of experience between politics, business and science and new conditions in the labour market are discussed by the social partners. Use of outputs to shape policy is also noted in other PES (**EE, CY, ES, HR, HU**).

The majority of PES believe that outputs from skills intelligence are useful for the purpose of service design and improvement. For example, **BE-Actiris** uses them not only as the basis of its own policy, but also for recommendations to the Brussels government and input for training providers. In **FR**, the outputs are used as part of the governmental Skills Investment Plan (Plan d'Investissement dans les Compétences-PIC) as well as the recovery plan 'France Relance'. In **IE,** the Employment Permit System (operated by the Department of Business) must refer to the skills-shortage indicators outlined in the National Skills Bulletin, produced annually by SOLAS. In **SE**, the primary area of use is to start and develop educational specialisations, labour market policy initiatives and provide information to actors who work with issues related to skills supply.

Other examples of dissemination activities include communication and awareness-raising campaigns based on skills analyses, for example on the internet; press releases; social media etc. (**BE-Actiris**); presentation through the website (**PL**) or support for strategic decisions in some (EURES) recruitment projects, training areas to invest or defining ALMPs (**PT**).

Box 16: Adjustment of policy in Cyprus

> Skills intelligence via the everyday matching of vacancies with job-seekers identifies hidden skills gaps or mismatches and provides a very realistic and pragmatic picture of what skills and abilities are required by the employers. Consequently, this process will highlight and promote the adjustment of policy-making for future skills in such a way as to provide training and lifelong solutions for skills acquisition/reskilling, to satisfy the requirements of the labour market and for economic sustainability.

Source: PES survey.

PES use this information actively to support counsellors (**BE-VDAB, DE, BG, ES, LT, SI**) who need updated labour information on the changing labour market conditions and job requirements. It also serves development of IT procedures (**DE**) in the area of matching, self-exploration tools, occupational orientation and career guidance.

Box 17: Work and Study programme in Estonia

> The EE PES has a programme for employees 'Work and Study!' since May 2017. The goal of the measures is to prevent unemployment through updating the skills of the employees, thereby also supporting structural changes in the economy. The package of preventive measures includes services for both employees and employers. Employers can apply for the training grant to improve the skills and knowledge of their employees upon their recruitment in so-called 'bottleneck vacancies' and help them to adapt to changes due to company restructuring, the launch of new technology or an update to qualification requirements. The choice of training programmes is limited. In order to ensure that training courses provided by the 'Work and Study!' programme support the fields that are growing and in need of additional labour, the supported study fields are determined by the sectoral labour-force needs studies, conducted by the Estonian Qualifications Authority. Additionally, participation in selected basic skills-training courses is supported.

Source: PES survey.

A number of countries (**HR, SI, SK**) use outputs for shaping educational policies (including higher and vocational education). In **LT,** when planning the vocational (re)training of the unemployed, the choice of training programmes is considered, and the results of employer surveys and barometers are evaluated. Preparing the list of missing professions, which facilitates the entry and employment of third-country nationals, the situation of the specific profession (level of employment opportunities) is also considered according to the prepared barometer.

Similarly in **PL**, the Occupational Barometer provides information on the demand for occupations and facilitates the matching of labour demand and supply. By providing information on the demand for professions and qualifications, it supports the appropriate investment of national and EU funds. In **BG**, the information acquired during the process of employment mediation for the needs of new skills is systematised and included in motivated proposals to the designers of employment policies for measures to improve the skills of the workforce (training for green skills, digital skills).

PES also described how the outputs are used to support lifelong learning (Table 17).

Table 17: Use of skills-intelligence outputs to support lifelong learning

Use of outputs to support lifelong learning	No. of PES	Country/PES
Upskilling and reskilling programmes addressing future skills requirements	22	AT, BE-Forem, BE-VDAB, CY, DE, DK, EE, EL, ES, FI, FR, HR, HU, IE, IS, LT, NL, PL, PT, SE, SI, SK
Programmes addressing concerns of social and emotional proximity	3	AT, CY, FR
Development of practice-based learning using virtual platforms and digital resources for online learning	7	AT, BE-VDAB, BG, DE, EL, FI, FR
Acceleration of cooperation with private sector and civil society	8	BE-Forem, BE-VDAB, DE, HU, IE, LU, SE, SI
Supporting and strengthening career guidance as an inherent element of the PES service process	19	AT, BE-VDAB, BG, DE, DK, EE, EL, ES, FI, FR, HR, HU, IE, LT, LV, PL, SE, SI, SK

Source: own data on the basis of PES survey.

In the majority of organisations these outputs are used in upskilling and reskilling programmes addressing future skills requirements (22 PES) and supporting and strengthening career guidance as an inherent element of the PES service process (19 PES). Less often, outputs from future skills analyses lead to acceleration of cooperation with private sector and civil society (8) and are used in development of practice-based learning using virtual platforms and digital resources for online learning (7). Only few PES (3) used these results to develop programmes addressing concerns of social and emotional proximity.

3. SUCCESS FACTORS AND CHALLENGES IN DELIVERY OF FUTURE SKILLS INTELLIGENCE IN PES

3.1 Key success factors

The review of available sources allows for the identification of determinants of skills-intelligence systems' effectiveness, including:

- cooperation of government agencies and ministries of education and labour in providing integrated information on skills needs;
- combining the forecasting approach, demand/supply databases and sectoral-level research in the analysis and prediction of skills needs;
- integration of databases within one repository accessible to interested stakeholders at their respective levels of responsibility;
- combining long-term and short-term skills-forecasting methods;
- complementing the existing system of skills intelligence with innovative methods involving analysis of big data and use of artificial intelligence.

In addition to its emphasis on the necessary human and financial resources, the Cedefop framework[16] of the skills governance system is based on the assumption that well-functioning systems depend on many building blocks, such as:

- participation of key stakeholders in quality assurance in data collection and analysis on skills, legitimising results and developing a strategic vision and action plan for skills development;

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[16] Pouliakas K., Making labour market and skills intelligence policy relevant: How Cedefop supports countries, 17 October 2017.

- permanent institutional tools for sharing stakeholder views and validating diagnosis results between various government bodies and social partners;
- transparent legal regulations, as well as a management strategy that allows stakeholders to understand their roles and responsibilities in both the development and implementation of diagnosis results;
- ensuring access to information and the possibility of providing feedback by a wider group of potential beneficiaries and adapting information to the needs of various groups of recipients.

According to the PES survey, the **key success criteria** for setting up and running an effective skills-intelligence system include several points.

Having a **sound methodological framework** is a pre-requisite of proper and useful skills-intelligence system. This should embrace clear methodology and goals framing analysis, as well as a clear structure and sustainable systematics that ensure interoperability of the data in various systems, most preferably based on a taxonomy that allows for different analyses and to link to international skills intelligence, like ESCO. This classification should be linked to national skills classifications and statistics. It is also vital that information on skills and classifications of skills are **updated and relevant.**

Application of a **methodological mix** also helps to achieve desired results. This might involve traditional methods (qualitative, survey, experts methods), but should also focus on developing the use of modern algorithms as in 'machine learning', artificial intelligence, data mining, and scraping job advertisements/vacancy information and other relevant data from the internet to obtain information about current and future skills needs. This should be combined with econometric models, multivariate analysis, qualitative information and forecasting exercises. Quantitative and qualitative data should be effectively combined with the use of AI, in order to provide more accurate knowledge of future skills needs.

Organisational aspects play an important role in successful delivery of skills intelligence. In order to set up and successfully operate the skills-intelligence system, PES must ensure:

- human resources capacity, by providing qualified, motivated, trained and stable core staff, with adequate technical, analytical and communication skills;
- sustainable funding sources, not only covering initial investment, but ensuring proper daily operations and development of the system;
- dedicated (top) management support ensuring enough time and support for innovation and development of the new system;
- strategic focus, by involving key staff and carefully plan how the results will be used to inform evidence-based policy;
- constant development, improvement and monitoring – ensuring a permanent controlling process.

Cooperation with external stakeholders is another crucial aspect of successful skills intelligence. This should focus on methodological aspects, like sharing skills classification, data analysis, exchange of best practices. Cooperation with social partners and scientific and research institutions should also aim at developing the methodology. Cooperation with employer associations enables data to be gathered from employers, while cooperation with external (academic) research institutes facilitates the learning process. By cooperating with external experts, know-how is shared and support is offered in the launch phase of the research.

Participation of stakeholders also helps to broaden knowledge about local labour markets. Cooperation with social partners is key to getting relevant data, but even more importantly to disseminating findings and ensuring their practical application. This involves engagement of various stakeholders: employers (including employers' associations), local and regional job and vocational training centres, other PES departments and other public authorities. It is important to take a holistic approach, based on good practices and the

contribution of involved stakeholders. This also requires a clear communication strategy for the main outputs, both internally and externally. Other surveyed PES experiences and lessons learned include:

- Importance of centralising role of the work-team coordinator in decentralised approach involving many external actors, deciding who classifies, structures and analyses the information and monitors the evaluation (**ES**);
- More reasonable list of skills to efficiently analyse skill-related data (**FR**);
- Research competence, gained by experience in research and analysis (**LT**);
- Necessary outsourcing in smaller PES without internal capacity, especially with big-data analysis (**LU**);
- More efforts should be made to coordinate research nationally (**SE**).

Box 18: Good practice example – Coordination of the OSKA surveys in Estonia

The **EE** PES uses the results of **labour demand surveys on sectoral needs for labour and skills (OSKA),** conducted by the Estonian Qualifications Authority. The implementation of OSKA is overseen by the OSKA Coordination Council with 11 members. The Council plays a key role in matching labour market needs with training resources, taking into account the proposals and suggestions put forward by sectoral expert panels. The work of the Council is supported by the Estonian Qualifications Authority. The Coordination Council approves the list of sectoral expert panels and their policies and practices. It approves sectoral reports and proposals put forward by expert panels. The Coordination Council consists of the representatives – board members or organisation heads – of the Ministry of Education and Research, Ministry of Economic Affairs and Communications, Ministry of Social Affairs, Ministry of Finance, Ministry of the Interior, the Bank of Estonia, the Estonian Employers' Confederation, the Estonian Chamber of Commerce and Industry, the Estonian Service Unions Confederation (TALO), the Estonian Trade Union Confederation and the Estonian Unemployment Insurance Fund.

OSKA Panel of Advisers

The OSKA Panel of Advisers contributes to the development of the OSKA methodology and to preparing the decisions of the Coordination Council. It has the task of being a partner and adviser to the Estonian Qualifications Authority. While the Coordination Council comprises representatives appointed by managements of organisations and authorities, the Panel of Advisers includes, besides the organisations represented in the Coordination Council, the best experts in the labour market and education fields from Estonian universities, research companies, professional associations, etc.

Sectoral Expert Panels

Sectoral expert panels were established in the Estonian Qualifications Authority to prepare forecasts of labour requirements and skills in OSKA sectors. The expert panels bring together the best experts from among job creators, schools and public authorities. Sectoral expert panels help to look at the whole picture of the needs for labour and skills in each sector. Forecasts of workforce and skills requirements, including proposals for delivering the desired changes, are prepared with the support of analysts and a coordinator of the Estonian Qualifications Authority. The proposals may be addressed to very different stakeholders, such as training providers, developers of curricula, professional associations, etc.

Source: PES survey

3.2 Key challenges and barriers

The joint ILO, Cedefop, ETF and OECD report[17] identified the **barriers to the implementation of skills-intelligence systems**, which include:

- lack of human resources with appropriate knowledge and experience;
- lack of funds;
- lack of coordination between agencies involved in diagnosis;
- weak statistical infrastructure;
- lack of interest/support from policy-makers;
- lack of credibility and accuracy of previous analyses.

The key barriers include the lack of funds and human resources (especially the required technical knowledge), as well as the lack of coordination between the organisations involved in the diagnosis. Among the remaining difficulties, the problem with access to data, especially at the local level (disaggregated data with a high degree of detail) was also indicated, which makes it difficult to formulate more local interventions.

An important element in overcoming barriers is building an infrastructure that allows for the diagnosis of the current and future-oriented skills needs. The report of the European Commission[18] shows that there is a clear division between EU countries regarding the technical capacity to develop diagnoses of the need for skills – especially in terms of forecasting. Some countries have mature analytical and forecasting infrastructures, while others are still in the construction or development phase.

According to the ILO report[19], a specific problem is also the lack of skills allowing decision-makers to understand the results of analyses, interpret them and translate them into the framework of labour market and education policy. Therefore, technical knowledge should be developed both in institutions directly involved in diagnosing the need for skills, as well as among stakeholders, ministries and government agencies that formulate policy assumptions (mainly educational and employment) and implement them. The challenges identified in previous reports[20] also include issues of data quality and the lack of integration of existing systems. Forecasting and labour market analysis systems are often fragmented, which makes it difficult to prepare cross-sectional analyses.

The ILO report[21] highlights the barriers in the area of transition between diagnosis and policy formulation and implementation. According to the report, these barriers mainly result from the lack of consultation with stakeholders. An important barrier in many countries is the weak dialogue between ministries, unclear division of responsibilities and the lack of legal empowerment. Therefore, it is necessary to support dialogue at various levels as well as formal and legal solutions allowing for effective coordination of activities.

The OECD report[22] identifies two key barriers to a wider and more effective use of information on skills needs. First, the diagnostic methodology adopted does not match the potential formulation applications and policy implementation. For example, the way of

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[17] Skills needs anticipation: systems and approaches. Analysis of stakeholder survey on skill needs assessment and anticipation, ILO, Geneva 2017.

[18] European Commission, Skills Governance in the EU Member States. Synthesis Report for the EEPO, Directorate-General for Employment, Publications Office of the European Union, Luxembourg 2015.

[19] Skills needs anticipation: systems and approaches. Analysis of stakeholder survey on skill needs assessment and anticipation, ILO, Geneva 2017.

[20] European Commission, Skills Governance in the EU Member States. Synthesis Report for the EEPO, Directorate-General for Employment, Publications Office of the European Union, Luxembourg 2015.

[21] Skills needs anticipation: systems and approaches. Analysis of stakeholder survey on skill needs assessment and anticipation, ILO, Geneva 2017.

[22] OECD (2016), Getting Skills Right: Assessing and Anticipating Changing Skill Needs, OECD Publishing, Paris.

defining skills does not match the solutions used in a given country; results may be presented in an 'overly technical' way; and they may not be sufficiently disaggregated at regional, local or sectoral level. Secondly, key stakeholders may not be sufficiently involved, and even when they are, misunderstandings often arise about skill needs and the direction of public intervention required, necessitating consensus building. Typically, a closer linkage with policy objectives requires direct involvement of system end-users, e.g. PES, at all stages of system implementation.

Also the PES survey revealed a number of barriers to the development of a skills-intelligence system (Table 18).

Table 18: Key barriers to the development of skills-intelligence systems

Challenge	1. Very significant		2. Significant		3. Not relevant	
	No. of PES	Country/PES	No. of PES	Country/PES	No. of PES	Country/PES
High costs of analyses/system	5	CY, DE, EL, LT, SK	12	BE-Forem, BE-VDAB, BG, DK, ES, IE, IS, LV, NL, PL, PT, SI	7	AT, BE-Actiris, FI, FR, HR, HU, SE
Lack of qualified/experienced staff	12	BE-Forem, BG, DE, ES, FI, HU, IS, LT, LU, LV, PT, SI	5	EL, FR, NL, PL, SK	6	AT, BE-Actiris, BE-VDAB, DK, HR, SE
Regulatory framework (e.g. data protection legislation)	5	AT, CY, DE, HR, HU	10	BE-Actiris, BG, FI, IE, LU, LV, NL, PL, SE, SI	8	BE-Forem, BE-VDAB, DK, ES, FR, IS, LT, PT
Ethical concerns	0	0	3	FI, LV, SI	16	AT, BE-Actiris, BE-Forem, BE-VDAB, BG, DE, DK, ES, FR, HR, HU, IS, LT, NL, PT, SE
Inadequate ICT support/lack of IT infrastructure	6	BG, CY, ES, LT, LV, SI	11	AT, BE-VDAB, DK, EL, FI, HU, IE, IS, NL, PL, PT	6	BE-Actiris, BE-Forem, DE, FR, HR, SE

Source: own data on the basis of PES survey.

Among very **significant barriers** to the development of skills-intelligence systems, PES surveyed mentioned in the first place the **lack of qualified and experienced staff** (12 PES). This problem was deemed significant by another five PES and six considered it not relevant. Inadequate ICT support and/or lack of IT infrastructure was the second factor of importance, with six PES considering it very significant, and 11 a significant factor. High cost of analyses and/or the system was also important, with five PES giving it highest priority and 12 considering it to be significant. Out of the important factors, regulatory framework (e.g. data protection legislation) was deemed a very significant barrier by five PES and significant by 10. This factor was however considered not relevant by eight PES. The only one factor found to be less significant was ethical concerns, which 16 of the surveyed PES considered as irrelevant.

Out of the **other barriers** mentioned by PES, one should note:

- Limited amount of data (**AT**);
- Lack of proper infrastructure for knowledge-based learning (**FI**);
- Identification of the best corresponding IT tools (**LU**);

- Methodological concerns due to lack of skills-based classification, which poses a problem in implementing a skills-intelligence system (**PL**).

Surveyed PES were asked to describe the biggest barriers in more detail and outline the actions taken to overcome them. A number of PES mentioned problems with the lack or shortage of staff, including shortage of experienced staff (**NL, LU**), high staff rotation resulting in lack of competence (**PL**) and the lack of trained skills-assessment specialists as an obstacle to the introduction and systematic use of a skills-intelligence system (**BG**).

One of the most significant barriers mentioned by PES was the **high cost of system development and implementation**, both in terms of direct investment (ICT infrastructure, database development and integration) and indirect investment (development of staff, cooperation, time devoted). It usually occurs in parallel to ongoing PES processes, which consume organisational resources, so additional provisions are needed but are not always available, especially in a time of post-COVID recovery. As noted by some PES, more advanced developments, involving big data and AI, require high initial investment, which does not (yet) appear to be economically viable (**DE**). High costs connected to data mining and big data are coupled with long periods of time to set up and make them operational (**AT, SI**), and the need for adequate IT infrastructure to be in place (**DK**).

In **DE**, the service existed in the BA since the 1970s and today forms the basis for numerous IT procedures, including vocational orientation tests such as Check-U, NewPlan and the Vocational Psychology Service ('Berufspsychologischer Service'). IAB tools such as the Futoromat also use these data. Currently, they are mainly maintained by human-cognitive editorial care. The task for the future will be to establish a more AI-supported approach here. The challenge is the initial investment cost of the conversion (editorial maintenance must continue).

PES noted and described in more detail the **problems related to the availability of data**. Although there are a lot of data, some are covered by statistical confidentiality and are not available (**SE, LU, HR, BG**). Moreover, collection and sharing of some data due to these restrictions are challenging (**IE**). Therefore, efforts are made to change regulations on access to individual data. Sometimes the (small) scale and diversity of the labour market causes problems with the availability of (big) data (**AT**). As noted by **BE-VDAB**, the data gathered were not primarily focused on the AI application, but rather for more traditional matching of job-seekers and vacancies. This proved a challenge for the further application of such data for more advanced analytics. **BG PES**, for instance, notes that it is important to collect information for a purpose. Also in **BE-VDAB**, the activity was not aligned with a sectoral approach to distinguishing occupations and skills, which caused debate with sectoral bodies and opposition from some industries.

Involvement of stakeholders might also pose a significant barrier to the development and smooth running of the system. Skills intelligence and experts in anticipation are often scattered across different organisations making it somewhat challenging to form an overall picture of future skills needs (**FI, FR**). Several development projects have been implemented in relation to these problems, like meetings and workshops to better understand the skills requirement in specific professional fields with involvement of different stakeholders (companies, social partners, skills operators in **FR**). It requires proper infrastructure for knowledge-process coordination. In **EL,** close collaboration with experts is being fostered. But cooperation with suitable technology providers that could adequately support skills intelligence might be challenging (**LU**).

One of the outstanding problems is also a lack of good practices in development of more advanced methods, especially for pioneering PES (**BE-VDAB**).

Box 19: Addressing barriers in PES

In **BE, Le Forem** decided to 'make instead of buy in' the development of a skills-intelligence system. Therefore training of staff was essential, as the same person (analyst) has to cope with computing skills, interviewing external experts, analysing information, writing reports and digests, presenting findings and reviewing literature.

In **LT**, to overcome the lack-of-qualified-staff barrier, the Employment Service invests in employee training. Employees of the Monitoring and Analysis Division and the Planning and Monitoring Division participated in in-service training, learning to work with the specialised statistical programme STATA. For better data analysis, some of the staff of the Monitoring and Analysis Department improved their knowledge of how to apply SQL programming language. The Lithuanian Employment Service tackled the barrier of inadequate ICT support/lack of IT infrastructure by preparing IT development projects for the Recovery and Resilience Facility (RRF) plan for the European Commission. It also presented specific challenges to GovTech Lab Lithuania (GovTech Lab Lithuania project is a part of the Agency for Science, Innovation and Technology and has received funding from the European Regional Development Fund).

In **SI**, development of a skills-intelligence system (skills taxonomy based on ESCO) is very time-consuming process. Its implementation affects all segments of the ESS main activities. Costs are high and it requires a step-by-step approach (one action as a base for another, which also makes it possible to upgrade the system gradually). Novelties require substantial leadership and staff support as well as new knowledge (understanding the value-added work with skills in the operational processes, etc.). In the SI case, skills-intelligence development calls for greater support in terms of human resources and a more holistic approach in order to explore/achieve its full potential.

In **ES**, the SEPE's objectives for 2021 include updating the technology used by the Occupations Observatory's processes and improving the visibility of its reports. It requires incorporating technical personnel and ongoing support from the Sub-Directorate-General for Information Technologies (SGTIC), which is working on digitalising all the Observatory's work projects. It also calls for openness to collaboration with other entities and organisations, to increase the capacity of the Observatory and its regional network to penetrate the labour market and analyse information. In this way, increasing the participation of external agents in information gathering, continuous improvement of information sources, and information quality is to be achieved. On the staff training side, it is necessary to train staff to use technology tools and new methodologies to ensure efficient use and correct information analysis.

Source: PES survey.

4. CONCLUSIONS

An unambiguous or universal definition of the goals of future skills-intelligence systems from the point of view of the labour market is very difficult. Undoubtedly, however, the planned objectives of the system should respond to the identified development barriers related to the demand for skills and allow for the development of an evidence-based public policy – both with regard to short-term interventions and designing its long-term assumptions.

Four **key recommendations** were formulated in the ILO report[23] for the development of systems for diagnosing the need for skills:

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[23] Skills needs anticipation: systems and approaches. Analysis of stakeholder survey on skills needs assessment and anticipation, ILO, Geneva 2017.

- **ensuring a sufficient statistical base** (data), as all skills-analysis systems, whether directed to current or future needs, require reliable and regular data updates;

- **building and sustaining technical capacity**, enabling a group of organisations involved to generate and update regular skills-needs diagnoses and country-specific forecasts;

- **building and/or further developing a well-coordinated network** of ministries and other stakeholders, with clear and legally regulated powers to take action to diagnose current and future skills needs, analyse the results obtained, and support the process of translating analysis into policy and practice;

- **gradual and consistent expansion of the methods used** as part of the diagnosis of skills needs. New methods should not be introduced too quickly and leave time for effective use of existing methods while learning new ones. Correct interpretation of the results and their use in policy requires appropriate experience.

Therefore, it is generally recommended that **organisations developing or strengthening skills-intelligence systems should pursue their integration on several levels**:

- **integration of goals** – through the review, analysis and coordination of policy goals (mainly educational and employment) and matching solutions in diagnosing the need for skills;

- **data integration** (databases) – by building infrastructure and knowledge (technical capacity), allowing for the creation of high-quality diagnoses and forecasts, reliable from the point of view of end-users;

- **stakeholder integration** – by involving them in work on the system at all stages (from preparation of assumptions, through data collection and analysis, to results interpretation), which will allow for optimal use of the results in designing public interventions and long-term state policy applications.

The output of the research (data delivery, level of aggregation, etc.) must be in line with the agreed policy objectives and significantly contribute to evidence-based policy-making. These general recommendations should be followed by all the organisations involved in the system of skills intelligence. Some more PES-specific recommendations have been formulated below.

PES in Europe play an important – either leading or otherwise active – role in skills-intelligence systems. A **majority of the PES already analyse future skills needs**. This skills intelligence is notably used in career guidance as well as upskilling and reskilling programmes. Their involvement is crucial in the provision of up-to-date information and future-looking analyses that allow for the better alignment of labour market demand and supply. It should be noted that existing systems and their recent developments create a solid basis to build on. Data, information and insights gathered through existing tools are used to support policy by providing a relevant evidence base. Examples of good and emerging practices have been identified through the survey, ensuring that PES are ready to undertake further challenges on the road to having comprehensive skills-intelligence systems.

PES in Europe should play a pivotal or at least an active role in further efforts to strengthen skills-intelligence systems. As evidenced by PES, in order to achieve this aim it is necessary to further develop the systems by **putting more emphasis on**:

- **strengthening skills focus** – a traditional approach often prevails, with the research focused on occupations, not skills. Therefore, further work is needed to deepen the understanding of a future skills perspective, e.g. by adopting skill-based classifications like ESCO or national level skills repositories.

- **developing a more holistic methodological approach** – a number of studies take a more quantitative perspective, with qualitative methods used alongside and more robust approaches (data mining/big data, AI, machine learning) still in their infancy. It is recommended to balance the use of different methods (using methodological mix) as the best foundation for evidence-based future skills policy.

- **developing a common framework** – as skills intelligence starts out with an exploration of the language used by job-seekers and employers and aims to bridge the differences. The analysis of vacancies is a way to ensure that placement and training meet the needs of companies. However, specialised software and artificial intelligence are needed to analyse vacancies and match skills data to provide in-depth, granular and timely data and information.

- **involving external and internal stakeholders** – strong involvement of stakeholders assists the development and execution of skills analyses, as well as uptake of outputs and research findings in relation to education and labour market policies and practices. Tailoring information to different users (institutional and individual) and making information more accessible and usable is a key step to be taken. Moreover, internally it is crucial to ensure management support, as well as the involvement of ICT and research/data analysis staff.

- **balancing and coordinating demand and supply perspectives** – while there is a clear link between the two, often studies are not connected and are prepared in different timeframes. Efforts should be made to balance the supply and demand sides of future skills requirements by creating methodologies and databases that take into account both perspectives.

- **providing information for different timeframes and policy applications** – it is crucial to provide up-to-date, short-term information (for aligning policies with current skills requirements), as well as more forward-looking studies (for addressing the future changes in demand, serving future skills matching). Information must be useful to policy-makers in the fields of labour and education, as well as to employers and vocational and lifelong guidance professionals.

- **strengthening PES potential in relation to skills intelligence** – organisational aspects such as qualified and motivated staff, ICT infrastructure and stable financing play an important role in PES ability to provide valuable skills insights. Therefore, it is crucial to strengthen PES capacity in this area.

Finally, **PES can learn from each other,** as evidenced by the 2022 PES Network Seminar. However, skills intelligence should be seen as a journey, with continuous learning as the way forward.

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6. INDEX OF ABBREVIATIONS

Actiris - Regional employment office in Brussels (Belgium)

ADEM – Luxemburg PES (Agence pour le développement de l'emploi)

AI – Artificial Intelligence

ALMP – Active Labour Market Policy

BA – Bundesagentur, German PES

BIBB – Federal Institute for Vocational Education and Training (Germany)

Cedefop – European Centre for the Development of Vocational Learning

EIAD – National Institute of Labour and Human Resources (Greece)

ELSTAT - Hellenic Statistical Authority (Greece)

EQF – European Qualifications Framework

ESCO – classification of European Skills, Competences, Qualifications and Occupations

ETF – European Training Foundation

EURES – European Employment Services

HRDA - Human Resource Development Authority, Cyprus PES

IAB - The Institute for Employment Research (Germany)

IDA – Industrial Development Agency (Ireland)

ILO – International Labour Organization

ISCED - The International Standard Classification of Education

ISCO – International standard classification of occupations

Le Forem – Public Service for Employment and Vocational Training in Wallonia (Belgium).

LMI – Labour Market Intelligence

LMIS – Labour Market Information Systems

NACE – EU classification of economic activities

NAV – Norwegian Labour and Welfare Administration

NEPS - National Education Panel (Germany)

NQF – National Qualifications Framework

O*NET – Occupational Information Network (O*NET) developed under the sponsorship of the U.S. Department of Labour

OAED – Greek PES (Labour Employment Office)

OECD – Organisation for Economic Cooperation and Development

PES – Public Employment Services

QUBE - Qualification and Occupation in the Future (Germany)

ReferNet – Cedefop's network of institutions providing information on national vocational education and training (VET) systems and policies

ROME – French classification of occupations (Répertoire Opérationnel des métiers et des Emplois)

SEPE – National Public Employment Service (Spanish PES)

SLMRU - Skills and Labour Market Research Unit (Ireland)

SOLAS - The Further Education and Training Authority (Ireland)

UNESCO - United Nations Educational, Scientific and Cultural Organization

VDAB – Public Employment Office of Flanders (Belgium)

6.1 List of country abbreviations

AT – Austria

BE – Belgium

BG – Bulgaria

CY – Cyprus

DE – Germany

DK – Denmark

EE – Estonia

EL – Greece

ES – Spain

FI – Finland

FR – France

HR – Croatia

HU – Hungary

IE – Ireland

IS – Iceland

LT – Lithuania

LU – Luxemburg

LV – Latvia

NL – Netherlands

NO – Norway

PL – Poland

PT – Portugal

SE – Sweden

SI – Slovenia

SK – Slovakia

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