Enabling Data Analytics for Actions Tackling Skills Shortages & Mismatch

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ACRONYMS

Acronym	Explanation
AMS	Public Employment Service of Austria
ΑΡΙ	Application Programming Interface
DSGI	Digital Skills Gap Index
DYPA	Public Employment Service of Greece
ELS	OECD Directorate for Employment, Labor, and Social Affairs
ELSTAT	Hellenic Statistic Authority
ESCO	European Skills, Competences, Qualifications and Occupations
ESI	European Skills Index
ILO	International Labor Organization
ML	Machine Learning
OECD	Organization of Economic Cooperation and Development
SEPE	State Public Employment Service of Spain
VET	Vocational Education and Training
WISE	World Indicators of Skills for Employment



EXECUTIVE SUMMARY

This document discusses the functional requirements for new indicators and visualizations for the TRAILS platform toolkit, synthesizing insights from earlier tasks. The primary output of D1.3, (REVIEW III - Functional Requirements for the TRAILS Innovations, due in month 10) is to describe the TRAILS's technological advancements compared to existing solutions. It outlines a set of new indicators and other visualization tools to be included in the TRAILS's platform to contribute to the project's main objective, which is to increase awareness about skills mismatch. It starts by emphasizing the importance of various indexes and mechanisms developed by various organizations and nations to assist policymakers in addressing skill mismatches and shortages, assessing labor market trends, and enhancing skills development. Most available mechanisms focus on firm-level analysis, examining skills gaps (inadequate employee skills) and shortages (insufficient skill supply). Then, aggregates the main attributes of these indexes and presents the main aspects of the platform.



1. PURPOSE OF THE DELIVERABLE

Task 1.3 involves reviewing and defining the functional requirements for the upcoming indicators and visualizations accessible to stakeholders and the public through the TRAILS toolkit. These indicators and visualizations will result from integrating the bottom-up approach in T1.2 and the expert analysis conducted in T1.1. The outpudeliverableTask 1.3 include D1.3, REVIEW III - Functional Requirements for the TRAILS Innovations, due iwhich is n month 10. This report will specioutlin LS's technological advancements and detaiprovide l the ed information aboutnew indicators and mechanisms to be developed throughout the project.

1.1 RELATION WITH OTHER DELIVERABLES AND TASKS

Task 1.3 receives input from Tasks 1.1 (D1.1) and 1.2 (D1.2), the early findings of Task 2.1 (D2.1), Task 2.2 (D2.3) & Task 3.1 (D3.1), and outputs REVIEW III - Functional requirements for the TRAILS innovations (D1.3). This report of D1.3 (REVIEW III), will inform workpackages 3, 4, and 5.

It is relevant to the following deliverable tasks of workpackages 3, 4, and 5 as it (a) reviews the corresponding international and national indicators and mechanisms developed by various organizations and nation, (b) presents TRAILS innovative indicators, and (c) provides information about TRAILS portal content, data and insights. The deliverables, this reports contributes to, are:

- D3.1 COMPARE-I: Skills mismatching in Europe pre- and post-pandemic (M12)
- D3.2 COMPARE-II: Technological change, training and upskilling in Europe (M24)
- D3.3 COMPARE-III: The impact of skills mismatching on well-being across sectors (M28)
- D3.4 COMPARE-IV: Behavioural, social, and cultural change for successful development of skills matched to needs (M32)
- D4.1 NOVEL-I: Using machine learning to measure skills matched to needs (M18)
- D4.2 NOVEL-II: Teleworking, digitization and labour market segmentation (M24)
- D4.3 NOVEL-III: Skills matching and firm resilience in the post-Covid era (M30)
- D4.4 NOVEL-IV: Technological empowerment of skills matching (M33)



- D5.1 PORTFOLIO-I: Training for labour market inclusiveness and resilience (M18)
- D5.2 PORTFOLIO-II: Resilient education and training in the era of automation and climate
- change (M23)
- D5.3 PORTFOLIO-III: Skills portfolios and new types of labour (M26)
- D5.4 PORTFOLIO-IV: Skills portfolios in times of change (M34)



2. INTERNATIONAL INDICATORS

The Organization for Economic Cooperation and Development (OECD) has developed the "World Indicators of Skills for Employment" (WISE) to provide insight into the skills of OECD countries between 1990 and 2014. WISE features five types of indicators, and the corresponding matching indicators include four primary components: (1) the ratio of overqualified or underqualified workers, (2) skills shortages, (3) changes in earnings by education and occupation, and (4) changes in unemployment rates by education. These matching indicators effectively capture the relationship between skills supply and demand in the labor market. Fig. 1 displays the skills gap indicator for various countries between 2003 and 2014.

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Customise * Export *	& My Queries *								
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ai Sov	Total at								
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UNI	2003	2004	2005	2006	2008	2009	2010	2013	2014
H Year	A ¥	A ¥	A ¥		A ¥	A ¥		A ¥	
H Country									
ite				41.8			40.7		
lombia				29			44.5		
sta Rica			13.4				38.3		
echia			12.6			29.3		19.5	
tonia			6.3			30.4		5	
rmany 🕕			7						
eece			8.6						
ngary			14.2			6.4		10.1	
and			15.6						
ael 🕐								12.3	
rea			6.8						
tvia			20.2			39.1		26.7	

Figure 1: Skills Gap Indicator - Source: https://stats.oecd.org/Index.aspx?QueryId=62775# (Accessed 27/02/2024)

Additionally, the **OECD Directorate for Employment, Labor, and Social Affairs (ELS)** has created an innovative tool called "Skills for Jobs" (**Fig. 2**) that helps identify skill imbalances in OECD countries. This interactive visualization enables users to explore which skills match various occupations. It is powered by the comprehensive Skills for Jobs database 2022, which encompasses data from 43 OECD countries and draws from sources like Australia, Canada, New Zealand, Singapore, the United States, and the United Kingdom. **Fig. 3** compares the skills supply and demand in Greece, highlighting which skills are overabundant and which are scarce relative to the OECD



averages. The skills are categorized in two lists, the "In Excess" one, which is shown on the left side of the chart, and the "Hard to find" one on the right side. Skills like "Arts and Humanities Knowledge", "Communication Skills" and "Attitudes" are oversupplied in Greece while other skills such as "Medicine Knowledge", "Training and Education" and "Scientific Knowledge" are in demand. Also, the chart uses two colored dots, the orange dots representing the OECD averages and the blue ones signifying the Greece's specific skill levels.



Figure 2: "Skills for Jobs" Tool. Source: <u>https://www.oecdskillsforjobsdatabase.org/index.php#EL/</u> (Accessed 27/02/2024)





Figure 3: "Skills for Jobs" Tool: The case of Greece -

Source: <u>https://www.oecdskillsforjobsdatabase.org/index.php#EL/_</u> (Accessed 27/02/2024)



The International Labor Organization (ILO) offers a helpful tool called the ILO Exploration Tool on Skills Mismatches (Fig. 4) within the same context. This tool expands on the OECD visualization by incorporating low- and middle-income countries and highlighting them in blue on the map. The user can visualize occupational and skills shortages by simply clicking on the country's name. The indexes presented rely on data collected from household surveys conducted by the National Statistical Offices of the examined countries. Please note that the coverage of each index may vary from country to country based on data availability.



Figure 4: The ILO Exploration tool on Skills Mismatches Source: <u>https://www.ilo.org/skills/areas/skills-training-for-poverty-reduction/WCMS_835486/lang--en/index.htm</u> (Accessed 29/02/2024)

Allow us to provide an illustrative example using Serbia. Upon selecting the country's name, a bubble plot displaying the occupational shortage index by year (**Figure 5**), a bar plot depicting the skills shortage by year (**Figure 6**), and a heatmap showcasing the occupation shortage index by year with accompanying instructions (**Figure 7**) are readily available.





Figure 5: The ILO Exploration Tool on Skills Mismatches: Occupational Shortage Index's Bubble Plot of Serbia- Source:



https://webapps.ilo.org/shinyapps/skillsforjobs/ (Accessed 29/02/2024)

Figure 6: The ILO Exploration Tool on Skills Mismatches: Skills Shortage Plot of Serbia - Source: https://webapps.ilo.org/shinyapps/skillsforjobs/ (Accessed 29/02/2024)





Heatmap of Occupation Shortage Index (OSI) of Serbia (ISCO version:08)

Figure 7: The ILO Exploration Tool on Skills Mismatches: Heatmap of Occupation Shortage Index of Serbia - Source: https://webapps.ilo.org/shinyapps/skillsforjobs/ (Accessed 29/02/2024)

Within the framework of the European Skills Agenda, the European Commission has created the EU Skills Panorama, an online resource that offers data and visual aids on skills mismatches across different occupations, sectors, and nations. The information presented on this platform is sourced from various surveys, including Eurostat's Labor Force Survey, the survey on ICT usage by households and individuals, Cedefop's Skills Forecast, Cedefop's European survey on jobs and skills, and Cedefop's Skills Ovate (which utilizes online job postings). The management of this tool has been entrusted to Cedefop. Figs. 8 to 11 depict the available charts in the section of "Skills Mismatch".



Fig. 8 constitutes a map of Europe that visualizes the over-qualification rate of tertiary graduates aged from 25 to 34 within Europe in 2022. This indicator spans from 9% to 38.5% and its country-specific level is aligned to different shades of blue. From the EU Countries, Greece has the higher over-qualification rate at 38.5% while Luxembourg exhibits the lowest rate at 9%.



Figure 8: EU Skills Panorama: Overqualified Graduates (%) for Age Group 25-34 in EU in 2022 – Source: https://www.cedefop.europa.eu/en/tools/skills-intelligence/trend-focus/skills-learning#7





Figure 9: EU Skills Panorama: Underuse of Skills at Job – Source: <u>https://www.cedefop.europa.eu/en/tools/skills-</u> <u>intelligence/trend-focus/skills-learning#7</u> (Accessed 29/02/2024)

Moreover, **Fig. 9** presents a bar chart that shows the proportion of workers reporting significant underuse of skills at jobs in EU27 in 2021, categorized by economic sector. The highest underuse of skills at job is observed in health and social care (52%), mining and quarrying (51%), and professional services (51%), whereas the lowest one in agriculture, forestry and fishing (29%). EU Skills Panorama also provides information on the mismatch of qualification with job by occupation and the mismatch of field of study with job by sector in EU27 in 2021, which are visualized in **Figs. 10** & **11** respectively. In particular, the treemap in **Fig. 10** shows that the highest level of discrepancy between education completed and education required by job is reported for elementary workers (39%), while the lowest



for professionals (21%). Similarly, the bar chart in **Fig. 11** reveals that arts & recreation, and other services demonstrates the highest share of workers with mismatch of field of study with job (40%), with the lowest share being reported in mining & quarrying (12%).

	Farm : Professionalis 21.0%	and related worker	rs: 29% Trad	ies workers 25.0%	Considerir study at yo (business, relevant is	ng your main subject or field o our highest level of education engineering, health etc.), how it for doing your main job?
Managers 22.0%	Operators and as 32.0%		Service an	d sales workers 8 5.0%		
	Clerks 29.0%	Elerr wo	nentary rkers	Farm and related workers		
Assoc	iate professionals 26.0%	39	9.0%	29.0%		
Mismatch o Elementary	of qualification with job a / workers exhibit the high	verage in EU27 in test value equal to	2021 is estimate 39%, while Pro	ed at 28.7%. fessionals the		

Figure 10: EU Skills Panorama: Mismatch of Qualification with Job – Source: https://www.cedefop.europa.eu/en/tools/skills-intelligence/trend-focus/skills-learning#7 (Accessed 29/02/2024)





Figure 11: EU Skills Panorama: Mismatch of Field of Study with Job – Source: <u>https://www.cedefop.europa.eu/en/tools/skills-intelligence/trend-focus/skills-learning#7</u> (Accessed 29/02/2024)

CEDEFOP has developed the **European Skills Index (ESI)**, a comprehensive gauge comprising three elements: skills development, skills activation, and skills matching. The ESI assesses the annual performance of EU skills systems from 2017 to 2024. **Fig. 12** displays the 2024 ESI for each EU member state, and users can access detailed information on individual country pillars by clicking on the corresponding nation. For instance, selecting EL for Greece provides access to **Figs. 13** and



14. Fig. 13 presents the performance of Greece in each component of the ESI. The left circular chart shows information on the score achieved by Greece at pillar level. With an overall ESI of 28, Greece scores 20 in Skills Matching, 35 in Skills Development, and 37 in Skills Activation. Similarly, the right circular chart illustrates Greek performance in the corresponding sub-pillars, namely Skills Mismatch (10), Basic Education (48), Training and other Education (22), Transition to Work (49), Labor Market Participation (26), Skills Utilization (34), and Skills Mismatch (10). The achievements of Greece in the 15 fundamental individual indicators of the ESI, are presented in **Fig. 14**. It can be clearly seen that Greece scores higher in Pre-primary Pupil-to-Teacher Ratio (73), Early Leavers from Training (79), and Low-wage Workers (79).



Figure 12: The European Skills Index (ESI)- Source: <u>https://www.cedefop.europa.eu/en/tools/european-skills-</u> <u>index?y=2024</u> (Accessed: 29/02/2024)



Figure 13: The European Skills Index (ESI) for Greece –

Source: https://www.cedefop.europa.eu/en/tools/european-skills-index/country/greece (Accessed: 29/02/2024)



Skills Development in Greece	<mark>4.</mark> 6
Basic education	
Pre-primary pupil to tracher ratio	78
Upper secondary attainment (and above)	64
Reading, maths & science scores (aged 15)	0
Training and other education	
Recent training	8
VET students	29
High digital skills	27
	.
Skills Activation in Greece	-
Transition to work	
Early leavers from training	79
Recent graduates in employment	4
Labour market participation	
Activity rate (aged 25-54)	35
Activity rate (aged 20-24)	17
Activity rate (aged 20-24)	17
Activity rate (aged 20-24)	17
Activity rate (aged 20-24) Skills Matching in Greece	17
Activity rate (aged 20-24) Skills Matching in Greece	17
Activity rate (aged 20-24) Skills Matching in Greece Skills utilisation	17
Activity rate (aged 20-24) Skills Matching in Greece Skills utilisation Long term unemployment	17 0
Activity rate (aged 20-24) Skills Matching in Greece Skills utilisation Long-term unemployment Underemployed part-time workers	17 0
Activity rate (aged 20-24) Skills Matching in Greece Skills utilisation Long term unemployment Underemployed part-time workers Skills mismatch	17 • • • • • • • • • • • • • • • • • • •
Activity rate (aged 20-24) Skills Matching in Greece Skills utilisation Long term unemployment Underemployed part-time workers Skills mismatch Over-qualification rate (tertiary graduates)	17 0
Activity rate (aged 20-24) Skills Matching in Greece Skills utilisation Long-term unemployment Underemployed part-time workers Skills mismatch Over-qualification rate (tertiary graduates) Low-wage workers (SCED 5-8)	17 0

Figure 14: The European Skills Index's Components for Greece –

Source: <u>https://www.cedefop.europa.eu/en/tools/european-skills-index/country/greece</u> (Accessed: 29/02/2024)

Organization	Indicator	Туре	Geographical Area	Period	Frequency
OECD	WISE	Dataset	OECD Countries	1990-2014	Annual
OECD ELS	"Skills for Job"	Tool	OECD Countries	2022	-
ILO	ILO Exploration tool on Skills Mismatches	Tool	Low- and middle- income countries based on data availability	-	Annual

Table 1: List of the International Indicators on Skills Mismatch



European Commission	EU Skills Panorama	Tool	EU27	2021&2022	Annual
CEDEFOP	European Skills Index	Tool	31 European Countries	2017-2024	Annual



3. NATIONAL INDICATORS

As per the European Skills Agency, EU member states have established their own mechanisms for tracking, assessing, and predicting labor and skill demand and supply. These platforms offer valuable insights and data visualizations on industry trends and facts, enabling policymakers, researchers, and labor market participants to address skill gaps and mismatches. **Table 2** outlines the policy instruments implemented by each EU country.

Country	Mechanism	Period
Austria	JobBarometer / AMS Qualifications- Barometer	2017-2022
Belgium	view.brussels / Brussels Observatory for Employment & Training	04/2009-02/2024
Cyprus	Trends and Forecasts of Employment and Training Needs	2022-2023
Czech Bepublic	Sector CouncilsNational System of Occupations	_
	National System of Qualifications	
Finland	Labor Force Barometer	12/2023 & 10/2024 (forecast)
Germany	Labor Market Monitor: Skilled Labor Radar	2022
Greece	Mechanism of Labor Market Diagnosis	2015-2022
Ireland	Skills & Labor Market Research (SOLAS)	2015-2023
Italy	Permanent National Information System for Occupational Needs: The Professions Portal	2011
Latvia	Labor Market Forecasting Platform	2020-2040
Netherlands	Skills Dashboard	2024
Poland	Portal of the Pomeranian Labor Market Observatory	2010-2024
Spain	The Observatory of Occupations: Training Needs of Occupations	-

Table 2: List of the EU Countries' National Mechanisms on Labor Market & Skills



Sweeden	The Occupational Compass	2024
Estonia	OSKA Studies	2017-2024

The Austrian Public Employment Service (AMS) has developed a helpful tool called the "JobBarometer" (see Fig. 15) that provides valuable insights into the trends of fifteen professions in Austria's job market. These professions are grouped into fifteen categories, as shown in Fig. 16. By selecting a specific sub-category, users can access data on trends, facts, and figures, and average salaries for that profession within the corresponding professional group and Federal State. Additionally, Fig. 17 offers information on the Austrian business and technology sector. The job data used to power this tool is sourced from job advertisements between 2017 and 2022.



Figure 15: The AMS JobBarometer - Source: https://jobbarometer.ams.at/ (Accessed: 29/02/2024)



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🖤 Mining raw materials, glass, ceamics, store	+
Office, marketing, finance, legal, security	+
Chemistry bioschrology foot plastics	+
a Destrical engineering electronics, telecommunications, IT	+
A Tade, logistice, transport	+
2 Agriculture formative formativ	+
R Mechanical engineering automobiles, metal	+
Media, graphica, design printing art, crafts	+
B Dening housekeeping semi-skilled and unskilled jobs	+
Social, health, beauty care	+
A Teols, cothing fashion, leafter	+
2 Tavisn, tooptally, kiure	+
A Eniromet	+
b Science, education, research and development	+
ingelike internen Greis Allenine ingel ingenser Mangadige	
Americal (Franker)	

Figure 16: The Main Professions in the AMS JobBarometer - Source: <u>https://jobbarometer.ams.at/berufe.html (</u>Accessed:

29/02/2024)



	Broke bases Reports and special topics How does the JobBerometer work	2	
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	commental and industrial companies, should be mentioned. The parliestions are consecuted industry. In parent, comer prospects in the upper cocupational proup "business and technological sectors	ingly diverse and senser prospects depend heavily on the development of the respective og/ tend to be positive.	
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	Trends, data and facts	O Associativy >	
Field of the state of the st	Poheadora Initia poheadoral pous All confessiona	Advalators	
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The formation of the fo	The following prophets allow how the importance of the profession will develop in the control or show of the stati adverturement volume for all profession in Acatria or the selected federal processe (parties there). All the same time, the contex of advecturement from the processe	gyes from the purer (perspective, and how prest the importance is purerity (measured as a state). The importance can decrease in the fourier (regarine trend), remain the same or persy which surreagend to the shares, is also share.	
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	winning parties Rects and Reports The Glosen graphics when the Section of Advancements in most par- ied most as the Advancement of the Section and Advancements in most par- ied most as the Advancement contractors theory and expression (SE) and ADV Advancements and Advancements and Advancements and Advancements in Market (SE) and ADV	typ population was not as by failed was and it sumprises to professions in addition, checky failed from the de advancements (average about for the years 2000 in 2000 in 2000 in proceedings control.	
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Figure 17: Trends in the Austrian Business & Technology Sector - Source: <u>https://jobbarometer.ams.at/berufe/290</u> (Accessed: 29/02/2024)

Presented next is the **Brussels Observatory** for employment and training, known as "*view.brussels*" (**Fig. 18**). "*ViewStat*," a tool offered by *view.brussels*, offers comprehensive information on job offers and unemployment in the Brussels Capital dating back from April 2009 to February 2024 on a monthly basis. This information is presented using a variety of graphs and tables (**Fig. 19**).





Figure 18: "View.brussels" - Source: <u>https://www.actiris.brussels/nl/Burgers/view-brussels</u> (Accessed 29/02/2024)



Welcome to ViewStat



On ViewStat, you can quickly and easily consult the main statistics on unemployment in the Brussels-Capital Region and the job offers received by Actins. The application offers a wide choice of basic statistics illustrated graphically and also allows you to create detailed tables and time series yourself. Statistics on job demand are available down to the municipal level. All data is updated monthly. Data can also be saved and/or processed in PDF/PNG/KLS format.

Figure 19: The "ViewStat" Tool – Source: https://viewstat.actiris.brussels/?lang=nl (Accessed 29/02/2024)

The **Cyprus Human Resource Development Authority** is a resource for gaining insights into the current state and future prospects of the Cypriot economy. Their analysis, as depicted in **Figure 20**, is divided into three main sections: projections for employment needs, projections for training needs, and long-term employment and training trends. These insights provide a comprehensive view of the labor market in Cyprus, including job requirements and the skills needed to succeed in various industries. **Figure 21** illustrates the labor demand projections for the period from 2022 to 2032 in Cyprus. This projection provides valuable information on the expected growth of the labor market in the coming years, including which industries are likely to see the most growth and what types of skills will be in high demand. This information can be useful for job seekers, employers, and policymakers in planning for the future and making informed decisions about education and training programs.



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		Cyprus	November 2012)				

Figure 20: Trends and Forecasts of the Employment and Training Needs for the Cypriot Economy– Source: https://www.anad.org.cy/wps/portal/hrda/hrdaExternal/researchAndStudies/studies/trendsandforecasts/!ut/p/z1/0 4_Sj9CPykssy0xPLMnMz0vMAfljo8ziPTw8HD0s_Q38DCw9TQ0C_YPdLEzcXZxMfcz0w8EKDHAARwP9KEL6o1CVuLu GGRkEWrg6m7oEWxpbuhjgV2BiZohfgb-LCVQBHkcW5EYYZHqmKwlAO3PopQ!!/dz/d5/L2dBISEvZ0FBIS9nQSEh/ (Accessed 03/03/2024)





Figure 21: Forecasts on Labor Demand in Cyprus for the Period 2022-2032 (in Greek)– Source: https://app.powerbi.com/view?r=eyJrljoiYTIwYmRhZTltZDIyOC00NTAxLWE2YWYtYjBlOTJkM2RjMmExIiwidCl6ImUwMGY wOTkyLWZjNWUtNGVkNi05MTFiLWY5MjVlZjc2YzYzNylsImMiOjl9&pageName=ReportSectionc9aabbedf633f389f199 (Accessed 03/03/2024)

In addition, the **Czech Republic** has implemented the **Sector Councils' platform** (as illustrated in **Figure 22**) to address the issue of skills mismatch. This platform closely tracks the labor market and identifies the necessary qualifications and skillsets required for each sector. The Sector Councils rely on two sources of information, namely the National System of Occupations (as depicted in **Figure 23**) which provides an overview of the current state of professions in the Czech labor market, and the National System of Qualifications (as seen in **Figure 24**), which contains a comprehensive database of all qualifications that are officially recognized and confirmed by the Czech Republic.





Figure 22: Czech Republic's Sector Councils– Source: <u>http://www.sektoroverady.cz/</u> (Accessed 03/03/2024)


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Figure 23: Czech Republic's National System of Occupations – Source: <u>https://www.nsp.cz/</u>

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Field of qualification	These are (1661) qualifications	in fai dabilase
Transport and connections	Polygraphy, processing of paper, film and	
Ecology and environmental protection	()	
Economy	Pool mousily and tood chemistry	(1)
Economics and Administration	Law, legal and public administration activity	CBD
Electrical engineering, telecommunications and	Journalism, librarianship and informatics	(14)
computer engineering	Special and interdisciplinary fields	(11)
Gastronomy, hotel industry and tourism	2) Construction, geodesy and cartography	(101)
Mining and mining geology, metallurgy and foundry	Engineering and engineering production	(127)
Information fields	Technical chemistry and chemistry of silicates	
Leather and footwear production and plastic 3	Physical culture, physical education and sport	(11)
	Testile production and clothing industry	(M)
- HADE	Arts and applied arts	(11)
History majors	Veterinary medicine and veterinary prevention	
Personal and operational services	Agriculture and forestry	(195)
Pedagogy, teaching and social care	7) Wood processing and production of musical	(72)

Figure 24: Czech Republic's National System of Qualifications – Source:

https://www.narodnikvalifikace.cz/ (Accessed 03/03/2024)



The Ministry of Employment and Economy in Finland has devised an innovative way to gather data on the country's present and future occupational and skills requirements. Known as the "Labor Force Barometer," this tool, formerly known as the "Occupational Barometer" (as seen in Fig. 25), provides a visual representation of the job market's match, measuring the available workforce as a percentage of employers' needs for the current period (December 2023) and predicting the same for the next year (October 2024). Fig. 26 employs a geospatial mapping approach to demonstrate the mismatch between labor supply and demand across different Finnish regions, showing a gradient of labor shortages severity. The severity of labor shortages is illustrated using a color coding, ranging from alarming to mild, with darker shades corresponding to more severe shortages. The Barometer also ranks Finland's skills and occupations in descending order, highlighting the most significant shortages Additionally, users can access all this information in table form, as demonstrated in Fig.

27.



Figure 25: The Labor Force Barometer- Source: <u>https://tyovoimabarometri.fi/#osaamiset</u> (Accessed 08/03/2024)



National situation

Situation of labour market match (December 2023) Forecast for labour market match (October 2024) Legend Labour shortage Labour mismatch problems Oversupply of labour Labour market equilibrium Greatest shortage SKILLS OCCUPATIONS 1. Digital competence 2. Professional qualification 3. knowledge of domestic languages 4. operating in a multicultural environment 5. Taking into account the special needs of customers 6. expertise in mental health and substance abuse work 7. medical treatment skills 8. Multidisciplinary cooperation Scale 9. information security 10. group and interaction skills 41: Moderate Mild

The whole country's situation as a table

Figure 26: The Labor Force Barometer: The Situation in the Finish Labor Market as a Map-Source: https://tyovoimabarometri.fi/#osaamiset (Accessed 08/03/2024)



The whole country's situation as a table						
	The	table describes	the number of available	workers in proportion to er	mplayers' needs.	
Name of region	Information	Open jobs	Number of employed	Number of unemployed	Situation	Severity of the situation
Central Finland	December 2023	2 141	109 324	15 168	Oversupply of labour	Serious
Skirt	December 2023	4 255	152 473	18 015	Oversupply of labour	Moderate
Resounds	December 2023	1268	27 481	2.803	Labour mismatch problems	Moderate
Lapland	December 2023	4 367	71600	8 076	Labour mismatch problems	Serious
North Karelia	December 2023	1698	61 449	9 399	Oversupply of labour	Serious
North Ostrobothnia	December 2023	5 513	167 599	21003	Oversupply of labour	Serious
North Savo	December 2023	3 317	100 778	11 375	Labour mismatch problems	Moderate
Ostrobothnia	December 2023	3 822	105 751	7 294	Labour mismatch problems	Moderate
Pirkanmaa	December 2023	7 239	224 717	23 309	Labour mismatch problems	Moderate
A hundred	December 2023	2 3 3 4	86 570	8 929	Oversupply of labour	Moderate
South Ostrobothnia	December 2023	2 533	79 405	5 749	Labour mismatch problems	Moderate
South Savo	December 2023	1833	50 687	5646	Labour mismatch problems	Moderate
Southeast Finland	December 2023	2 191	112 093	14 295	Oversupply of labour	Serious
Southwest Finland	December 2023	6 146	207774	20 912	Labour mismatch problems	Moderate
Uusimaa	December 2023	20 671	812 018	86 775	Oversupply of labour	Moderate

Figure 27: The Labor Force Barometer: The Situation in the Finish Labor Market as a Table - Source: <u>https://tyovoimabarometri.fi/#osaamiset</u> (Accessed 08/03/2024)

The **German Federal Employment Agency** has recently introduced three categories of interactive statistics related to the demand for skilled workers. These include data on the need for skilled workers, bottleneck analysis, and the skilled labor radar, all of which are detailed in **Figure 28**. Among these statistics, the most valuable tool for addressing concerns related to skills mismatch



and gaps is the skilled labor radar, depicted in **Figure 29**. This powerful resource provides insights into unemployment-job ratios, vacancy times, and skill requirements based on occupation and region. The data can be presented in a variety of formats, including maps, tables, and infographics, and pertains specifically to the year 2022.

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	Dashboard with selected data on demographic change for Germany, the states, districts and agency districts. > The labor market in the context of demographic change		Data on the foreign population, those seeking protec- tion, foreigners on the labor market for Germany and districts. > Migration.Integration.Regions		The statistics provide information on the impact of migration on the labor market according to <u>nationalit</u> Migration and the labor market
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N	eed for skilled workers		Bottleneck analysis	Labor	market monitor: Skilled labor radar
	Data on the need for skilled workers for Germany as well as countries, districts and labor market regions. > <u>Need for skilled workers</u>		Bottleneck occupations listed in tabular form for Germany and the federal states.		Unemployment-to-job ratio, vacancy times and other data on the need for skilled workers according to re- quirement level for Germany, the federal states and lu bor market regions. a Labor market monitor: Skilled labor radar
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TOP PRODUCTS	INTERACTIVE STATIS	ICS	BASICS	SE	RVICE
Monthly report	Labor market monitor		Logbook on changes and innovations to BA	tatistics (PDF, 991KB) Co	ntact, feedback and criticism
Skills shortage analysis	training market		glossary	Ne	wsletter

Figure 28: Federal Employment Agency: Interactive Statistics on the Need for Skilled Workers – Source: https://statistik.arbeitsagentur.de/DE/Navigation/Statistiken/Interaktive-Statistiken/Interaktive-Statistiken-Nav.html (Accessed 29/02/2024)





Figure 29: Federal Employment Agency: The Skilled Labor Radar – Source: https://arbeitsmarktmonitor.arbeitsagentur.de/faktencheck/fachkraefte/karte/515/7/0/ (Accessed 29/02/2024)

The Ministry of Labor and Social Insurance in Greece has created the Mechanism of Labor Market Diagnosis (shown in Fig. 30) to gather data from three sources: the Hellenic Statistic Authority - ELSTAT (providing labor market data), Ergani (providing data on employed labor), and the Public Employment Service - DYPA (providing data on registered unemployment). This mechanism analyzes and presents information on the demand and supply of skills in the labor market. It offers visualizations of trends such as the dynamism of occupations and sectors, occupational guides, underemployment, and analysis of demand and supply of salaried employment (as seen in Fig. 31) from 2015 to 2022. Furthermore, the mechanism maps the demand for 6,129 skills in 383 occupations in the information and communication sector in Greece using the European Skills, Competencies, Qualifications, and Occupations (ESCO) classification (shown in Fig. 32).





Figure 30: The Mechanism of Labor Diagnosis – Source: https://mdaae.gr/en/ (Accessed 29/02/2024)



Figure 31: Mechanism of Labor Diagnosis: Labor Market Trends – Source: <u>https://mdaae.gr/en/data_type/taseis-tis-</u> <u>agoras-ergasias/</u> (Accessed 29/02/2024)







Meanwhile, **SOLAS**, an agency of the **Irish Department of Further and Higher Education**, **Research**, **Innovation**, **and Science** (as shown in **Fig. 33**), offers a range of reports on regional skills for 2023. Accessing these reports is as simple as clicking on the corresponding region on the map featured in **Fig. 34**. These informative reports cover topics such as employment, unemployment, labor market trends, and occupations. Additionally, SOLAS' "Library" section provides the results of their "**Skills & Labor Market Research**" conducted between 2015 and 2023 (as depicted in **Fig. 35**).



7////

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SOLAS is committed to providing Further Education and Training programmes that are responsive to the rapidly evolving industries across Ireland. As such, SOLAS carries out and commissions regular skills and sector research, evaluative reporting and strategic planning for the future.

Search Library

Choose type

FET Strategies & Plans Annual Reports & Corporate Plans Evaluation Reports Skills & Labour Market Research Strategic Performance Agreements Data Analytics Construction Learner Support

Figure 33: SOLAS - Source: https://www.solas.ie/library/ (Accessed: 30/03/2024)





Figure 34: SOLAS: Regional Skills - Source: <u>https://www.solas.ie/research-lp/skills-labour-market-research-slmru/regional-skills/</u> (Accessed: 30/03/2024)



Skills & Labour Market Research	Skills & Labour Market Research	Skills & Labour Market Research
Regional Profile Infographic -	Regional Profile Infographic -	Regional Profile Infographic -
West Q3 2023	South West Q3 2023	South East Q3 2023
Download 🗲	Download 🗲	Download 🗲 🗲
Skills & Labour Market Research	Skills & Labour Market Research	Skills & Labour Market Research
Regional Profile Infographic -	Regional Profile Infographic -	Regional Profile Infographic -
Mid West Q3 2023	Midlands Q3 2023	Mid East Q3 2023
Download 🗲	Download 🗲	Download >
Skills & Labour Market Research	Skills & Labour Market Research	Skills & Labour Market Research
Regional Profile Infographic -	Regional Profile Infographic -	Monitoring Ireland's Skills
Dublin Q3 2023	Border Q3 2023	Supply 2023
Download 💙	Download 💙	Download >

Figure 35: SOLAS: Skills & Labor Market Research - Source: https://www.solas.ie/library/ (Accessed: 30/03/2024)

The **Permanent National Information System for Occupational Needs for Italy**, known as The Professions Portal, was developed by the National Institute for Public Policies Analysis and the National Institute for Statistics of Italy. This platform offers valuable insights into **professions**, **trends, characteristics, vacancies, and competencies** (as depicted in **Fig. 36**). Additionally, it presents the findings of the "Professions and Skills Survey" (as shown in **Fig. 37**), which was conducted in 2021 to assess the skills and knowledge required by businesses. The results are



categorized by industry or service, type of knowledge, and type of skills, and are available for every region in Italy.

	NI	Professions	Orientation P	rofessions System Classification
RESEARCH Type of search Search with the name of the professio	Search keyword E.g. Mechanic, Chef		lear	Instruments Orientation Cinematheque of professions
Professions Sett Image: Setter state of the set of t	NAPP, constitutes a cognitive resou are and evolutions, current or trend, ayment and training policies, organic	Territories	nomic and rid of work in human	Data and metadata Insights
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 Training operators to plan targeted interventio profiles Labor market operators to learn about profess Policy makers and public institutions to adopt with the times or to monitor the professional r 	ns to support employment and aim ions and facilitate the matching of just strategies and measures suited to t reeds and skills of staff	ad at better qualifying prof ob supply and demand he growth of the labor ma	essional rket in step	Wearing professions, study
gure 36: The Permanent Nationa https://v	al Information System www.inapp.gov.it/profe	for Occupationa assioni/ (Access	l Needs: The ed: 30/03/20	Professions Portal - Sour 24)



PROFESSIONI

Professions Orientation Professions System Classifications 🗸

Professions and Skills Survey

In 2021, the fourth edition of the Professions and Skills Survey (PEC) was carried out. The survey, carried out with the Cati (Computer assisted telephone interviewing) technique on a sample of 35,000 companies, aims to collect qualitative information on the needs of companies in terms of lack/lack of specific knowledge/skills related to the figures professionals present in private companies (the PA sector is excluded). In fact, entrepreneurs and personnel managers of large, medium and small companies are asked to indicate whether, with reference to the professions practiced in the company, it will be necessary or not in the following months to strengthen some specific areas of knowledge and competence to improve work performance. Companies are invited to respond, in particular detail, not on the training that has been carried out recently but on that which should be carried out in the near future to satisfy specific needs. The figures are traced back to the professional units they belong to classified within the lstat 2011 Classification of Professions (CP 2011).

The results of the survey feed the Portal in the Professions section. The proposed Focus refers to aggregate data and allows consultation of data organized by Industry/Services, Knowledge/Skills in relation to the entire national territory and by individual region.



Figure 37: The Permanent National Information System for Occupational Needs: Professions and Skills Survey - Source: https://www.inapp.gov.it/professioni/indagine-professioni-e-competenze/ (Accessed: 30/03/2024)

To illustrate, **Fig. 38** features a bar plot of the relative outcomes for companies in need for employees with written and oral communication and comprehension skills. In particular, eight core sectors of the Italian labor market, namely (1) legislators, entrepreneurs, and top managers, (2) intellectual, scientific, and highly specialized professions, (3) technical professions, (4) office workers and executive professions, (5) skilled professions in commercial services, (6) artisans, special workers, and farmers, (7) machine operators and drivers, and (8) unskilled workers, are assessed in terms of



their requirement for written and oral communication skills. The analysis suggests that communication remains a fundamental competency, particularly in sectors that involve interaction with others.



Figure 38: Professions and Skills Survey: Skills' Outcomes - Source: <u>https://www.inapp.gov.it/professioni/indagine-professioni-e-competenze/</u> (Accessed: 30/03/2024)

In Latvia, the **State Employment Agency Republic of Latvia** has developed an innovative **Labor Market Forecasting Platform** (**Fig. 39**) that provides valuable insights into short-term, mid-term (up to ten years), and long-term (up to 25 years) labor demand, labor market trends, and skills demand. These predictions are publicly available and updated annually, covering the period from 2020 to 2040. The platform also features short-term forecasts of skills demand by profession (**Figs. 40 & 41**), allowing users to tailor their skills to various professions and enhance their employability. **Fig. 40** shows the most demanding professions in Latvia according to the skills listed on the right side in descending order. The pie chart depicts professions such as lawyers, heavy truck drivers, police officers, salespeople, administrative managers and others, arranged based on specific skill requirements. These skills include among others compliance to regulatory requirements, communication and cooperation with various stakeholders, development of policies, implementation of strategies, and management of company activities. Also, **Fig. 41** provides a list of



skills according to their importance in the labor market. The skills are ranked on a scale of arrows, with the downward arrow meaning that the corresponding skill is not essential for the Latvian labor market and an upward one being an indicator of the skills relevance. Also, when the upward arrow is the case, the significance of the corresponding skill within the labor market increases with the number of arrows, with a five-arrow score signifying a highly important skill. Yet, this useful tool allows individuals to create their own basket of skills and prioritize their professional development accordingly.



Information on Labor Market Forecasting and Forecasts

Figure 39: The Labor Market Forecasting Platform – Source: <u>https://www.nva.gov.lv/lv/darba-tirgus-prognozes</u> (Accessed: 30/03/2024)





Figure 40: The Labor Market Forecasting Platform: Skills Forecast – Source: <u>https://prognozes.nva.gov.lv/en/skill-</u> <u>forecasts</u> (Accessed: 30/03/2024)

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abour demand	Select from the list or search for skills in the list	search engine and a	create your own skills	Choose skills from the skill list to create your own skill list	
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kill forecasts	I regulatory acts and other regulatory documents	11111	\oplus		
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escription	8 Plan and organize the work to be done	111	\oplus		
thodology	To observe the norms and principles of professional ethics	111	\oplus		
	6 Plan and implement the economic activity of the company	↑ ↑↑	\oplus		
	Be able to drive vehicles and be familiar with machinery	↑ ↑	\oplus		
	Ø Master the national language	^	\oplus		
	Output of the second	^	\oplus		
	Self-education, acquiring new knowledge and skills	^	\oplus		
	Develop an action policy	1 1	(+)		

Figure 41: The Labor Market Forecasting Platform: My Skills Tool – Source: <u>https://prognozes.nva.gov.lv/en/skill-forecasts</u> (Accessed: 30/03/2024)

The Institute of Employment Insurance and the Ministry of Social Affairs and Employment of **Netherlands** have collaborated to create a variety of dashboards regarding Dutch policies. These dashboards provide valuable information on labor market trends, forecasts, sectors, opportunities,



regions, and skills (see **Fig. 42**). The skills dashboard, in particular, offers detailed classifications and descriptions of the soft skills and tasks associated with each occupation, categorized by professional level. Though the skills dashboard is still in development, it is already proving to be a useful resource for workers and job seekers looking to enhance their prospects in the labor market. The information provided is updated annually in March, June, September, and December. **Fig. 43** presents the skills dashboard interface, and more specifically the four available search options. The user can choose among searching for a profession, searching based on job prospects, viewing skills and tasks for transition professions, and searching based on task or skill. For an example, refer to **Fig. 44** for the available skills description for Dutch accountants. The skills dashboard characterizes the job opportunities of the accountants' profession as "promising" and detects 800 relative vacancies in the fourth quarter of 2023. Moreover, it lists both the essential and the optional tasks and soft skills of this occupation.



Figure 42: Employee Insurance Agency of Netherlands: Labor Market Information – Source: <u>https://www.werk.nl/arbeidsmarktinformatie</u> (Accessed: 30/03/2024)





Figure 43: Employee Insurance Agency of Netherlands: Skills Dashboard – Source: <u>https://www.werk.nl/arbeidsmarktinformatie/dashboards/skills</u> (Accessed: 30/03/2024)



Figure 44: Skills Dashboard: Accountants – Source: <u>https://www.werk.nl/arbeidsmarktinformatie/dashboards/skills</u> (Accessed: 30/03/2024)



The **Pomeranian Labor Market Observatory's Occupational Barometer (Fig. 45)** offers a comprehensive view of the Polish labor market. Through various visualizations, it presents annual data on the dynamic relationship between employees and employers, changes in labor demand across different regions in Poland from 2010 to 2023, as well as forecasts for 2024 (**Fig. 46 & 47**). This information is presented in the form of maps, posters, and tables. Additionally, the Occupational Barometer categorizes professions into three groups, ranging from shortage to balance to surplus occupations, and includes infographics covering the period from 2010 to 2024 (**Fig. 48**).



Figure 45: The Pomeranian Labor Market Observatory – Source: <u>https://www.porp.pl/</u> (Accessed: 07/04/2024)



CCCUPATIONAL BAROMETER



Figure 46: The Pomeranian Labor Market Observatory: Occupational Barometer – Source: https://barometrzawodow.pl/ (Accessed: 07/04/2024)



Figure 47: Occupational Barometer: Forecast for 2024 – Source: https://barometrzawodow.pl/ (Accessed: 07/04/2024)



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Figure 48: Occupational Barometer: Infographics 2024 – Source: <u>https://barometrzawodow.pl/</u> (Accessed: 07/04/2024)

Within a comparable framework, the **State Public Employment Service of Spain (SEPE)** has unveiled the Occupational Observatory (**Fig. 49**). This innovative tool examines both the current state and future projections of the Spanish job market, while also pinpointing the necessary competencies for various occupations (**Fig. 50**). Users can access this information by entering a specific occupation into the search bar (**Fig. 51**). For instance, **Figs. 52 & 53** highlight the training requirements for economists. The Occupational Observatory differentiates between technical/professional skills and cross-functional skills.





Figure 50: Occupations Observatory: Publications & Reports – Source: https://www.sepe.es/HomeSepe/que-es-elsepe/que-es-observatorio.html (Accessed: 11/04/2024)

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	In the consultation Full reports the training needs of all occupations with better situation in the labour market analysed, as well as the training needs of families Professionals.	

Figure 51: Occupations Observatory: Training Needs of Occupations – Source: <u>https://www.sepe.es/HomeSepe/que-es-el-sepe/que-es-observatorio/deteccion-necesidades-formativas.html?documentType=prospecciones&</u> (Accessed: 11/04/2024)

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	Prediction models and economic analysis	
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	Tools for agile, reliable and versatile reporting	
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Figure 52: Occupations Observatory: Training Needs of the Economists in Technical Skills– Source:

https://www.sepe.es/HomeSepe/que-es-el-sepe/que-es-observatorio/deteccion-necesidades-formativas/resultados-

busqueda/detalle-necesidades-formativas.html?idOcu=2810 (Accessed: 11/04/2024)



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	Internet/Social Networks	ADVANCED	
	Text processor	ADVANCED	
	Database	ADVANCED	in
	Presentations	ADVANCED	
	Email	ADVANCED	
	Spreadsheet	ADVANCED	
	FINANCIAL KNOWLEDGE		
	Accounting		
	Financing means		6
	LANGUAGES		

Figure 53: Occupations Observatory: Training Needs of the Economists in Transversal Skills – Source: https://www.sepe.es/HomeSepe/que-es-el-sepe/que-es-observatorio/deteccion-necesidades-formativas/resultadosbusqueda/detalle-necesidades-formativas.html?idOcu=2810 (Accessed: 11/04/2024)

The Swedish Public Employment Service's Occupational Compass showcases over 200 professions on both regional and national levels, as displayed in Figure 54. Though it does not directly tackle skills mismatch, it offers a thorough depiction and synopsis of each occupation, presenting valuable insight for career decision-making. Figures 55 and 56 exhibit the pertinent details concerning the administration, economics, and law sectors and the role of accounting economists, respectively.



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Figure 54: The Swedish Public Employment Service: The Occupational Compass – Source: <u>https://arbetsformedlingen.se/for-arbetssokande/yrken-och-framtid/hitta-yrken/ (</u>Accessed: 07/04/2024)



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Figure 55: The Occupational Compass: Administration, Economics & Law Sector – Source:

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Figure 56: The Occupational Compass: Accounting Economist – Source: <u>https://arbetsformedlingen.se/for-</u> <u>arbetssokande/yrken-och-framtid/hitta-yrken/yrkesgrupper/1187</u> (Accessed: 07/04/2024)

The **OSKA Studies**, conducted by the **Estonian Qualifications Authority**, offer invaluable insight into the country's labor market needs (as illustrated in **Fig. 57**). This annual analysis covers the period from 2017 to 2024 and divides the entire Estonian labor market into twenty-five sectors, with five sectors selected for examination each year. The study's forecast period spans a decade, and **Fig. 58**



presents the current situation and corresponding predictions for specific sectors. In 2024, the examined sectors will be accounting and business consultation, family medicine, logistics, and transportation. Fig. 59 showcases the future outlook on labor and skills needs in the transport sector. The study monitors and forecasts labor demand and skills from 2023 to 2032 and has three components: (1) the study section that provides in-depth information on transport sub-sectors, (2) the materials section which includes several one-minute videos and summaries on skills and labor demand, and (3) the data section that features statistical evidence, forecasts, and diagrams for labor demand across different sub-sectors.



Figure 57: Estonian Qualifications Authority: The OSKA Studies – Source: https://oska.kutsekoda.ee/en/ (Accessed:

27/04/2024)





Figure 58: The OSKA Studies: Forecasts on Specific Sectors – Source: https://oska.kutsekoda.ee/en/ (Accessed:

27/04/2024)



Figure 59: The OSKA Studies: The Transportation's Sector – Source: <u>https://oska.kutsekoda.ee/en/</u> (Accessed:

27/04/2024)



4. OTHER INDICATORS

The **Digital Skills Gap Index** (DSGI) 2021, created by Wiley, is a powerful tool for addressing the digital skills gap. It evaluates 134 countries for 2021 across six key pillars: digital skills institutions, digital responsiveness, government support, supply, demand, competitiveness, data ethics and integrity, and research intensity. Countries are ranked based on their DSGI score in descending order and can be classified by income group. The mechanism features various visualization methods, such as interactive maps (**Fig. 60**), economy/location profiles, and economy/location comparisons. **Fig. 61** provides a useful comparison between Greece and Saudi Arabia, displaying their overall DSGI score as well as their score in each DSGI pillar.



Figure 60: Wiley's Digital Skills Gap Index (DSGI) 2021 – <u>Source: https://dsgi.wiley.com/</u> (Accessed: 27/04/2024)

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Figure 61: DSGI 2021: Economy / Location Comparison – <u>Source https://dsgi.wiley.com/economy-location-profiles/</u> (Accessed: 27/04/2024)



5. TRAILS INNOVATIONS

The following section is dedicated to a comprehensive examination of the functional requirements for the new indicators and visualizations that will be developed for the TRAILS portal toolkit. These indicators and illustrations are essential for enhancing the portal's usability and ensuring that stakeholders, including policymakers, educators, and industry professionals, can effectively access and interpret the data. By identifying and defining these requirements, we aim to create tools that facilitate informed decision-making and foster collaboration among different user groups.

The focus will be on determining the specific functionalities that these new features must offer, such as interactivity, real-time data updates, and user customization options. Additionally, we will explore how these indicators and illustrations can be tailored to meet the diverse needs of various user groups, ensuring that the information presented is not only accessible but also actionable. Ultimately, this section seeks to lay the groundwork for a robust and user-friendly toolkit that empowers stakeholders and the wider public to engage with the data in a meaningful way.

5.1 DATA-DRIVEN POLICYMAKING AND VISUALIZATIONS

By incorporating insights from previous sections of these deliverables and related deliverables such as D1.1, D1.2, and D2.1, it becomes evident that data collection, big data analysis, and visualization play a crucial role in data-driven policymaking. Rather than relying on ideological positions, datadriven policymaking analyses large datasets to better understand social, economic, and environmental challenges and the impact of new and existing policies. This enables policymakers to design and apply policies that are tailored to the real needs of society. The data-driven approach also ensures that interventions are targeted, efficient, and measurable, leading to better outcomes and increased effectiveness.

Visualization tools are an essential part of data-driven policymaking, as they help transform complex data into clear, understandable, and actionable insights. These tools enable decision-makers,



stakeholders, and the public to better understand the complexities of the data, ensuring that policies are designed based on evidence and analysis rather than intuition or assumptions. By converting raw data into charts, graphs, interactive maps, and other visual formats, visualizations simplify the information for policymakers. This allows them to quickly identify key trends, patterns, and relationships that may not be immediately apparent from raw data alone. In addition, visual representations provide an intuitive and accessible way to present information to non-experts, including the public, media, and other stakeholders. This fosters transparency and facilitates clearer communication of policies and their potential impacts.

Visualization tools also allow policymakers to detect trends and correlations between parameters, identify patterns over time or across regions, and compare different scenarios. These possibilities allow them to understand the consequences of various interventions and prioritize actions based on data-driven insights, something particularly important for monitoring the effectiveness of policies, evaluating long-term impacts, and forecasting future needs.

In addition, visualization tools enhance transparency and help build trust between citizens and government actions by making data more accessible and understandable.

5.2TRAILS INDICATORS

The indicators and mechanisms discussed in the previous sections of this deliverable will form the foundation for the TRAILS portal. Table 3 summarizes these indicators, categorizing them based on their common characteristics. The table groups the indicators not only by their tool functionalities - such as interactivity, filtering, comparability, and data export capabilities- but also by the specific topics they address.

Most of the tools offer modern dashboards with interactive charts and filtering options, allowing users to compare different variables, regions, and time frames. Tools used at the international level typically also provide data exporting functionalities for further analysis.

In terms of the topics they address, five main categories were identified:

(a) Skill mismatches and shortages,



- (b) Labor market trends and forecasts,
- (c) Skills development and activation,
- (d) Labor market dynamics, and
- (e) Regional and sector-specific insights.

International mechanisms primarily focus on skills mismatches and shortages, while national mechanisms provide valuable insights into labor market trends specific to their regions. These tools often report on regional and sector-specific insights and offer forecasts for future labor market developments. Additionally, a few tools include insights into skills development, activation, and labour market dynamics.

TRAILS portal will address both tool functionalities and the topics discussed previously. As a tool, TRAILS will offer a modern environment built on a state-of-the-art visualization engine, offering interactive and filterable charts to the users. At the same time, the data will be available to the public through different data exporting mechanisms like comma separated files, json based files an through an application programming interface (API).

	Тоо	ls func	tionali	ities	Topics						
Indicator / Mechanism	Interactive	Filtrable	Comparable	Data export	Skill mismatches and shortages	Labor market trends and forecasts	Skills development and activation	Labor market dynamics	Regional and sector-specific insights		
TRAILS Portal	~	~	~	~	\checkmark	~	~	~	~		
WISE	\checkmark	\checkmark	\checkmark	\checkmark	~						
"Skills for Job"	\checkmark	\checkmark	\checkmark	\checkmark	~						
ILO Exploration tool on Skills Mismatches	~	~	~	~	~						
EU Skills Panorama	~	~	~	~	~				~		
European Skills Index	\checkmark	\checkmark	\checkmark	\checkmark			~				
JobBarometer	\checkmark	\checkmark				\checkmark					
Brussels Observatory	\checkmark	\checkmark	\checkmark	\checkmark		~					

Table 3: Indicators characteristics and topics addressed



Trends and Forecasts of Employment and Training Needs	~	~				~			~
Sector Councils' platform		~			~				~
Labor Force Barometer	~	~			\checkmark			~	
Labor Market Monitor: Skilled Labor Radar	~	~			~				
Mechanism of Labor Market Diagnosis	~	~	~	~		~			
Skills & Labor Market Research (SOLAS)		~				~			
Permanent National Information System for Occupational Needs: The Professions Portal	~	~	~	~		~			
Labor Market Forecasting Platform		~	~			~			
Skills Dashboard		~				~	~		
Portal of the Pomeranian Labor Market Observatory	~	~	~			~			
The Observatory of Occupations: Training Needs of Occupations		~				~			~
The Occupational Compass		~							\checkmark
OSKA Studies		~				\checkmark			\checkmark
Digital Skills Gap Index	~	~	~						\checkmark

The TRAILS portal will address multiple dimensions of labour market analysis, making it a versatile tool for policymakers and stakeholders.



Firstly, it will focus heavily on skill mismatches and shortages, offering indicators of skills mismatches across occupations, sectors, and countries. The portal will highlight skill gaps and shortages by capturing the complexity of evolving labour markets and helping policymakers design targeted interventions.

Additionally, the portal will contribute to labour market trends and forecasts, providing projections for employment needs, skills demand, and sector-specific trends. This will help anticipate future labour market developments across European countries, allowing for better preparation and strategic planning.

The TRAILS portal will also deliver regional and sector-specific insights, presenting indicators on labour market conditions, skill needs, and training gaps across different regions and sectors. This regional focus will enable targeted policy interventions at both national and local levels, enhancing workforce development strategies.

Finally, the portal will provide valuable insights into skills development and activation, including vocational training and reskilling needs. It will also address labour market dynamics, such as changes in demand for certain professions and the evolving relationship between workers and employers.

5.3TRAILS PORTAL

In this context, TRAILS will integrate the dynamics of existing datasets with data collected throughout the project's lifetime, along with innovative visualization tools, to develop the TRAILS Portal. This modern tool will provide policymakers and the general public with access to all project indicators related to skills mismatches in the labor market and the role of adult learning in vocational education and training. Additionally, the portal will feature novel AI tools for skill profiling and matching.


Following the approach adopted by the tools presented in Sections 3, 4, and 5, the TRAILS portal will be built on an open-source visualization tool¹ that enables the creation of dynamic dashboards incorporating interactive charts, such as maps, spider charts, area charts, heatmaps, and more. These charts allow users to manipulate the data in real-time, enabling a deeper exploration of trends, patterns, and relationships. Users can zoom in on specific data points, filter information, and customize the views according to their needs, making the analysis more personalized and responsive. In addition, users can toggle between various views, overlay multiple data series, or highlight specific segments, making it easier to identify correlations and trends across different periods or categories.

The services the TRAILS portal will provide are depicted in **Fig. 63** and presented in the following paragraphs.





Statistics from various datasets

The portal will display summary and descriptive statistics from the datasets accessible to the consortium, with information updated regularly. This includes visual inspection of country-level differences in aspects of primary interest, alongside differences across key population groups, e.g.,

¹ Apache Superset. For a more thorough analysis of the TRAILS portal architecture, readers are encouraged to consult the deliverables of WP7.



by gender, age, and income/wealth/financial status, and an overview of the incidence of formal and informal training across countries. These statistics will be presented through various interactive maps and related filters, allowing users to select, display, and compare values across different countries. The visualization tool will also support simultaneous filtering across multiple panels, allowing users to create more personalized views based on the available data and their needs.

New skill mismatch indicators

Moreover, by utilizing the most advanced secondary data and applying cutting-edge machine learning (ML) methodologies, the consortium will assess the heterogeneity of skill mismatch across European countries. This analysis will track changes in mismatch rates over the past decade and explore how megatrends such as COVID-19, the rise of teleworking, and the green and digital transitions have influenced these mismatches. Additionally, the role of vocational education and training (VET), adult learning, and informal training as moderating factors will be examined.

The outcome of this process will be a set of meaningful indicators that capture skill needs and gaps associated with the green and digital transitions across the EU, as well as the transferability of skills across occupations and sectors.

The new indicators will be presented on the TRAILS portal through various advanced and interactive visualizations designed to make the data accessible and actionable for policymakers, educators, and other stakeholders.

Interactive maps will display the geographic distribution of skill mismatches across European countries, allowing users to zoom in on specific regions to explore how mismatch rates have evolved. Heatmaps will provide a clear, colour-coded overview of skill mismatches across sectors and occupations, making it easy to identify industries most affected by skill gaps and how they have shifted due to megatrends like COVID-19, teleworking, and the green transition.

Additionally, trend line charts and bar graphs will illustrate how mismatch rates have changed over the past years, highlighting the impact of trends such as digital transformation and the moderating role of vocational education and training, adult learning, and informal training. These visualizations will allow users to track the effectiveness of different interventions and policies over time. To explore the transferability of skills across occupations and sectors, spider charts and radar charts will present multiple dimensions of skills, showing how closely related different occupations are



regarding required competencies. This will enable users to visualize potential career transitions for workers and understand how skills can be applied in different industries.

Empirical results and insights

In addition, the TRAILS portal will present data resulting from empirical innovations conducted throughout the project. During WP2, the consortium will design a state-of-the-art household survey to collect primary data from approximately 24 EU countries and 4 EU candidates or neighbouring countries. This multi-country survey will elicit consumer preferences, attitudes, and decision-making regarding the need for upskilling and the determinants of VET choices. The TRAILS portal will host the raw data and the insights derived from the analysis. In this case, advanced charts with comparability features across countries will be employed, allowing users to observe key interest groups and analyze preference elicitation across alternative policy and choice scenarios.

New datasets on skills mismatch

In line with its goal of providing comprehensive insights into labor market dynamics, the TRAILS project will integrate newly collected datasets on skills mismatches to enhance the understanding of labor market inefficiencies. These datasets will be collected through various sources during the project's lifetime, to provide detailed information on the impact of skills mismatches across the European countries and multiple sectors.

The new datasets will cover aspects such as the disparity between the skills possessed by the employees and those required by employers, allowing for an in-depth analysis of skill mismatch, shortages and gaps. The TRAILS portal will use these datasets to generate new indicators of skills mismatch, focusing on various dimensions, such as differences by occupation, region, and sector, as well as specific population groups like gender, age, and education level.

These datasets will be visualized through dynamic and interactive dashboards on the TRAILS portal. The users will be able to explore these insights through customized visualizations, such as heatmaps, interactive maps, and trend charts. The ability to filter by country, sector, or demographic group will allow for more targeted analysis and enable policymakers to make data-driven decisions regarding workforce development and education strategies.



6. **DISCUSSION**

Tackling skills shortages and mismatches is substantial for enhancing sustainable economic growth in the EU. It promotes quality job creation, strengthens economic resilience amid geopolitical changes, and ensures EU competitiveness. This review gathers the most significant indicators and mechanisms employed to identify labor market trends and diagnose skill needs.

At international level, all the available tools are based on multidimensional indexes that utilize user – friendly graphical presentations of the relative measurements and are mainly addressed to policymakers and researchers. More specifically, **WISE** contains 64 individual indicators, in five areas including skills matching. This database can be used for by-country analysis as well as for comparisons over time and across countries. However, its coverage period is limited to 2014. Moreover, the **OECD's "Skills for Jobs"** tool as well as its extension, the "**ILO Exploration Tool on Skill Mismatches"**, are based on information collected from online job postings, featuring a comparative depiction of the current skills imbalances within occupations.

Similarly, **Cedefop's ESI** is a composite indicator that relies on 15 individual indexes, and has 3 pillars: skills development, skills activation, and skills matching. It measures each country's performance compared to 100%, which is supposed to be the ideal. Its eminence lies in the extensive use of original research across various skills systems in the EU. Also, it is worth noting that this powerful tool has been audited three times by the European Commission's Competence Center on Composite Indicators and Scoreboards (COIN) at the Joint Research Center (JRC), with the third one taking place in 2024 (Norlen & Saisana, 2018; Caperna & Becker, 2022; Smallenbroek & Ravanos, 2024). The 2024 ESI edition was audited regarding two principal aspects (Smallenbroek & Ravanos, 2024): (1) its statistical coherence, which encompasses the appropriateness of its components and its multidimensional composition, and (2) the robustness of its values given the modelling assumptions. This assessment confirmed that the ESI constitutes a reliable, balanced, and transparent index with good statistical coherence, that meets the international quality standards for statistical soundness.

As a comprehensive measure of both the overall performance of the EU skills system and the individual indicators, the ESI is a fundamental instrument of policymaking for skills and vocational education and training. Yet, it underlines not only the improvement of the EU Member State's skills



system but also the transition of the latter towards digital and green economies (Cedefop, 2024). Also, it facilitates the comparison of the skills system performance across different countries, taking into consideration the impact of demographic, economic, and technological factors as well.

Turning to national policy instruments for matching skill gaps, the EU member states have developed mechanisms that provide comprehensive and user - friendly visualizations of their results, primarily targeting career counsellors, workers, and job seekers that attempt to improve their prospects in the labor market. Most of them are focused on matching skillsets with the labor market needs. From this perspective, tools as the Austrian JobBarometer, the Finnish Labor Force Barometer, the Labor Market Forecasting Platform of Latvia, the Permanent National Information System for Occupational Needs for Italy, the Occupations Observatory of Spain, and the Dutch Skills Dashboard identify and visualize regional and sectoral skills needs, offer all the necessary information to handle any issues in skills and qualifications, and contribute to the development of relative strategies to overcome any barriers. These instruments vary in their update frequency, forecasting capabilities, and potential implementation challenges. For example, most content in the Austrian JobBarometer is updated on a six-month basis, with the latest version including information on green skills and gender issues. Also, it promotes inclusion by catering users with different qualification levels. Additionally, the Finnish Labor Force Barometer and the Dutch Skills Dashboard provide detailed and reliable information to enhance the prospects of job seekers to improve their job prospects. However, neither makes predictions, with the former identifying the qualification level and the unwillingness to relocate to a different region as factors that hinder effectiveness. Nonetheless, all these platforms can be used to develop educational and training programmes for both employed and unemployed individuals.

On the other hand, other national mechanisms as **the Belgian "view.brussels"**, **the German Skills Labor Radar**, **the Mechanism of Labor Diagnosis of Greece**, **the Pomeranian Labor Market Observatory's Occupational Barometer**, and the **Swedish Occupational Compass** have indirect or limited focus on skills mismatch. Nevertheless, they provide useful and accurate labor market information at national, regional, and sectoral level with extensive coverage in most cases.



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