EU4Digital

EU4Digital: supporting digital economy and society in the Eastern Partnership

Methodology for Measuring and Forecasting Digital Skills Gaps

July 2020

1. Abbreviations

Table 1. Abbreviations used in the Methodology

Abbreviation	Description
AM	Armenia
AZ	Azerbaijan
BY	Belarus
CEDEFOP	European Centre for the Development of Vocational Training
DESI	The Digital Economy and Society Index
DigComp	Digital Competence Framework for Citizens
Eastern partner countries	Armenia, Azerbaijan, Belarus, Georgia, Moldova, Ukraine
EC	European Commission
e-CF	European e-Competence Framework
EntreComp	The European Entrepreneurship Competence Framework
ESA95	European system of national and regional accounts
ESCO	European Skills, Competences, Qualifications and Occupations
EU	European Union
Eurostat	Official statistical office of the European Union
EU4D	EU4Digital Initiative
EY	Ernst &Young
GE	Georgia
ICT	Information and Communication Technologies
ISCO	International Standard Classification of Occupations
ISCED	International Standard Classification of Education
LFS	Labour Force Survey
MD	Moldova
Methodology	Methodology for Measuring and Forecasting Digital Skills Gaps
MS	EU Member States
NACE	Statistical Classification of Economic Activities in the European Community
NGO	Non-governmental organisation
NUTS	Nomenclature of territorial units for statistics
OECD	Organisation for Economic Co-operation and Development
Skills-OVATE	Skills Online Vacancy Analysis Tool for Europe
STAN	OECD's Structural Analysis Database
UA	Ukraine
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UOE	UNESCO, OECD and Eurostat joint methodology for education data collection

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3. Introduction

3.1. Objectives of the Methodology for Measuring and Forecasting Digital Skills Gaps

The EU4Digital Initiative (EU4D) was launched in 2016 to eliminate existing obstacles and barriers for pan-European online services for citizens, public administrations and businesses, including through the harmonisation of the digital environments among the Eastern partner countries and with the European Union (EU). The objective of the EU4D Facility digital skills thematic area is to improve legislative, regulatory and methodological framework conditions for digital skills and competences by, among other things, defining a **Methodology for Measuring and Forecasting Digital Skills Gaps** (Methodology) in line with similar EU efforts.

This document contains a summary of current Eastern partner country digital skills gap **measurement and forecasting approaches** and **recommendations** for the introduction of a common measurement and forecasting methodology aligned with EU practices. The Methodology is supplemented by six Eastern partner **country reports** that cover country specific results and recommendations.

The final version of this document together with the country reports constitutes the main deliverables of EU4D Facility activity 6.1. "Define a common methodology in the Eastern partner region, for measuring and forecasting national digital skills gaps of both women and men of all ages and identifying priority remedial actions, in line with similar EU efforts".

3.2. Approach for Developing the Methodology for Measuring and Forecasting Digital Skills Gaps

This Methodology was developed in the following steps:

- **desk research, interviews** to analyse EU Member State (MS) practices for implementing digital skills frameworks, digital skills gaps measurement and forecasting;
- development and information collection through a "**Questionnaire** on the currently used practices for measuring and forecasting national digital skills gaps in the Eastern partner countries" consisting of three sections:
    - general questions:
        - respondent information;
        - institutions responsible for digital skills measurement;
        - information and communication technology (ICT) and digital indicator types measured;
        - EU and international frameworks and methodologies adopted;
    - indicator categories[1]:
        - indicators describing general digital skills;
        - specific digital skills indicators for workforce, including for ICT specialists;
        - specific indicators measuring digital skills and use of ICT in Education;
        - other digital skills related indicators;
    - national plans:
        - plans to measure additional indicators in the future;
        - policies for indicator measurement;
        - willingness to adjust measurement to EU methodologies;
        - implementation of forecasting of digital skills;
        - incentives required to adapt indicator collection to EU methodologies.
- **validation of initial findings** with Eastern partner country representatives bilaterally and at the Digital Skills Network Workshop in Tbilisi, December 2019;
- **development of recommendations** for implementing a common methodology for measuring and forecasting digital skills gaps in line with EU MS practices;

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[1] For a list of indicators included in the benchmark, see Annex 2: DESI Human Capital, Use of Internet Services and Integration of Digital Technology Dimension Indicator Sources for Digital Skills Measurement and Annex 3: ICT in Education and Workforce Indicators

- **validation of results and recommendations** with Eastern partner country representatives (Digital Skills Network, Digital Skills Measurement Working Group representatives and other stakeholders) and preparation of deliverables.

4. EU MS Practices for Digital Skills Measurement and Forecasting

The collection of Eastern partner country digital skills gaps measurement and forecasting practice baseline information and development of recommendations for a common Methodology is **aligned with existing EU MS practices**: digital competence frameworks, data collection, measurement approaches and forecasting models.

4.1. EU Digital Competence Frameworks

Key EU MS frameworks for ICT skills and digital skills are:

- the **Digital Competence Framework for Citizens** (DigComp) describing digital competences for citizens;
- the **European e-Competence Framework** (e-CF) describing the competences for ICT professionals.

The frameworks serve two roles:

- **descriptive**: defines the competences that European citizens and ICT specialists need to remain competitive in the 21st century. These frameworks therefore serve as an initial reference for developing multiple training programmes for ICT specialists, workforce, students and general audience;
- **prescriptive**: defines measurement methodologies to evaluate digital competency and skill level on an individual basis (self-assessment tools, certifications) and develop digital skills benchmarks for the measurement of skills gaps for countries and regions.

Most of EU MS measure the digital skills of their population in accordance with the **Digital Economy and Society Index** (DESI) that is aligned with the competences described in DigComp.

4.2. Digital Skills Measurement Practices in EU Member States

4.2.1. Digital Skills Indicator

In May 2014, EC's Directorate-General for Communications Networks, Content and Technology and the Official statistical office of the European Union (Eurostat) Information Society Working Group agreed to develop and publish a "**Digital Skills Indicator**". The indicator is based on DigComp and was developed by the EU Science Hub Joint Research Centre and EC Directorate-General for Education, Youth, Sport and Culture. DigComp was chosen as it is the most common framework to describe the digital competences of the general audience ICT users. The framework identifies five competence domains: information, communication, content creation, safety and problem solving. Eurostat community survey on ICT usage in households and by individuals collects information on internet and computer user activities during the last three months and covers four out of five DigComp domains (the safety domain is not covered as adequate indicators for this domain are not yet available within the survey).

4.2.2. Digital Economy and Society Index

The DESI is the main index to measure the progress of EU MS towards a **digital economy and society**. It brings together a wide set of relevant indicators from EU's current digital policy mix to obtain a general characterisation of the performance of individual MS. DESI indicators are collected through various collection mechanisms, that have been aligned throughout EU MS to ensure comparability. Four main types of analysis are supported by the DESI:

- **performance assessment** for general characterization of **individual MS** performance by observing their overall digital competitiveness;
- **zooming-in to pinpoint areas where MS digital performance could be improved** by analysing specific sub-dimensions and individual digital competitiveness indicators;
- assessing **progress** over time;
- **comparative analysis** to cluster MS according to their digital performance, comparing countries in similar stages of digital development, and to flag the need for improvement in relevant policy areas.

DESI monitors the digital competitiveness of each EU MS in the following **Dimensions**:

- Connectivity;
- Human Capital;
- Use of Internet Services;
- Integration of Digital Technology;
- Digital Public Services.

For detailed DESI data Dimensions and Sub-dimensions, see Annex 1: DESI Dimensions and Sub-dimensionsAnnex 1: DESI Dimensions and Sub-dimensions.

Three out of five DESI Dimensions hold the most relevance (both direct and indirect) for the measurement and forecasting of digital skills of citizens and enterprises:

- Human Capital;
- Use of Internet Services;
- Integration of Digital Technology.

The DESI **Connectivity Dimension** only measures the internet coverage and cost. The **Digital Public Services** Dimension contains some indicators that relate to citizen digital skills through use of public services. However, as they cover public e-service use, while other DESI Dimensions already cover internet and e-service use by citizens and enterprises more generally, the specific public sector related indicators are not included in the benchmark of this report.

Indicators for the three DESI Dimensions related to digital skills are collected through **four data collection** mechanisms with annual frequency:

- **Eurostat community survey on ICT usage in households and by individuals**: annual survey conducted since 2002, collecting data on the use of ICT, the internet, e-government and electronic skills in households and by individuals;
- **Eurostat community survey on ICT usage and eCommerce in enterprises**: annual survey conducted since 2002, collecting data on the use of ICT, the internet, e-government, e-business and e-commerce in enterprises;
- **Eurostat labour force survey** (LFS): large sample household survey providing quarterly results on labour participation of people aged 15 and over as well as persons outside the labour force;
- **UNESCO, OECD and Eurostat** (UOE) **joint methodology of education data collection** provides a collection of aggregate national data covering student enrolments, student entrants, graduates, personnel, finance, class sizes and general population.

For an overview of how data for each indicator is collected, see Annex 2: DESI Human Capital, Use of Internet Services and Integration of Digital Technology Dimension Indicator Sources for Digital Skills Measurement. Data collection methods are explained below.

Table 2. EU MS digital skills data collection methods

Data collection methods	Description of the data collection approach
Eurostat community survey on ICT usage in households and by individuals	- Sample size is defined by the population of the country - Respondents: individuals in a household - Sampling methods: probability samples - Sample descriptors: age, gender, education level, employment status, geographical region
Eurostat community survey on ICT usage and eCommerce in enterprises	- Scope of the survey varies between EU MS, for example, in 2017, Malta had the lowest sample size (1,438), while Italy (21,410) and Germany (20,000) had the highest - Respondents: group of enterprises chosen by economic activity, enterprise size, geographical location

Data collection methods	Description of the data collection approach
Eurostat LFS	• The sampling designs applied in the Eurostat LFS are very varied, however EU MS mostly use multistage stratified random sample design • The sample used in Eurostat LFS is 0.42% in EU-27. Malta and Iceland (1.7%) have the highest sampling rate per quarter while most other countries have sampling rates of 1% or less • National Central Bureau of Statistics or equivalent institutions are responsible for selecting the sample size, preparing the questionnaires and conducting direct interviews with households
UOE joint methodology of education data collection	• The International Standard Classification of Education (ISCED) is the basis for international education statistics • Each country provides annual cross-referencing of their national education systems to the standard classification • Indicators on participation rates, enrolment statistics are combined with population statistics[2]

4.2.3. Education and Workforce Indicators

In addition to the three selected DESI Dimensions, additional indicators on education and employment also need to be assessed to cover a wider range of digital skills indicators, including student and workforce skills. For this purpose, two additional Dimensions were introduced within this study:

- **ICT in Education** that reflects the digitalisation of education which is crucial for developing digital skills from an early age. ICT in Education indicators also reflect the number of graduates with degrees qualifying them for workplaces based on digital processes and gives an insight on student's self-reported confidence of their digital skills[3];
- **ICT in Workforce** was introduced to gain deeper insights on the digital skills of workforce available from the Eurostat LFS.

For detailed list of education and workforce indicators see Annex 3: ICT in Education and Workforce.

In addition to providing deeper insight on specific digital skills areas, these indicators are also key in assessing country readiness for implementing quantitative methods for ICT labour force forecasting models. Common data collection methods and classification in these areas can support easier alignment to existing EU forecasting methodologies.

4.3. Skills and Labour Market Forecasting Practices in the EU

The **New Skills Agenda for Europe**[4] aims to improve the quality and relevance of training, to make skills more visible and comparable and to improve information and understanding of trends and patterns in demand for skills and jobs. While EU plans to improve the analysis and forecasting of skills needs (including through web crawling tools and analysis of big data), currently **systematic and regular cross-EU forecasts for digital skills are not implemented**. However, one-off skills forecasts, for example, *e-Skills in Europe: Trends and Forecasts for the European ICT Professional and Digital Leadership Labour Markets*[5] by Empirica have been conducted. Moreover, regional general labour market forecasts, vacancy tools and national-level initiatives can provide valuable inputs for assessing future digital skills needs.

Cross-European labour force forecasting is conducted through the **European Centre's for the Development of Vocational Training** (CEDEFOP) **Skills Forecast**. The Skills Forecast uses harmonised data and a common methodology to ensure comparable results across countries. The results can be aggregated to provide an overall picture of labour market trends and skill development in the EU and covers all EU MS and a few other

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[2]Eurostat (2016). UOE joint data collection – methodology. Available at: https://ec.europa.eu/eurostat/statistics-explained/index.php/UNESCO_OECD_Eurostat_(UOE)_joint_data_collection_–_methodology#Introduction

[3] EC (2019). 2nd Survey of Schools: ICT in Education Available at:https://ec.europa.eu/digital-single-market/en/news/2nd-survey-schools-ict-education

[4] EC (n.d.). New Skills Agenda for Europe. Available at: http://ec.europa.eu/social/main.jsp?langId=en&catId=1223

[5] Empirica (2015). e-Skills in Europe: Trends and Forecasts for the European ICT Professional and Digital Leadership Labour Markets. Available at: https://epale.ec.europa.eu/lv/node/17910

countries. Eastern partner countries are not covered. The methodology is based on a modular approach and can produce forecasts for 42 economic sectors including ICT, that are compatible with the European system of national and regional accounts (ESA95) and Statistical Classification of Economic Activities in the European Community (NACE) classification. Main data sources are Eurostat national level data, and specific data from Organisation's for Economic Co-operation and Development (OECD) Structural Analysis (STAN) database and the Eurostat LFS.

Another database developed by CEDEFOP that reflects labour market information is the **Skills Online Vacancy Analysis Tool for Europe** (Skills-OVATE). The tool is mostly based on online job advertisement and refers to skills and regions based on international classifications: International Standard Classification of Occupations (ISCO-08) for occupations, Nomenclature of territorial units for statistics (NUTS-2) for regions, European Skills, Competences, Qualifications and Occupations (ESCO) version 1 for skills and NACE rev. 2 for sectors. However, the tool is still under development and the full version is expected to be published by the end of 2020.

Furthermore, a key initiative under the **New Skills Agenda for Europe** is the **Blueprint for Sectoral Cooperation on Skills**, which builds on previous work by the EC and sectoral partners, including European sectoral skills councils and the Erasmus+ Skills Alliances. Under this initiative Sectoral Skills Alliances (Alliances) develop and implement strategies to address skills gaps in various sectors. Alliances gather stakeholders from business, trade unions, research, education and training institutions and public authorities.

The **Erasmus+ Key Action 2 Alliances** were launched in 2018 to address skills gaps in specific sectors of economy that correspond to one or more occupational profile. Alliances aim to identify current or emerging labour market needs that are specific to the sector and accordingly adjust the responsiveness of vocational education and training (VET) systems at all levels to the needs of the labour market. Emphasis was put on digital skills as they are increasingly becoming a horizontal requirement for job roles in all sectors of economy. The main goals of Alliances are:

- Identification of existing and emerging **skills needs for professions** in specific sectors;
- Strengthening the **exchange of knowledge and practice** between education and training institutions and the labour market;
- **Modernising VET** by adapting education supply to skills needs;
- Integrating **work-based learning** in VET to exploit its potential to drive economic development and innovation, increasing the competitiveness of the sectors concerned;
- Building mutual trust, facilitating cross-border certification and therefore **easing professional mobility** in a sector, and increasing recognition of qualifications on a European level;
- **Improving skills intelligence** and providing **a clear strategy and instruments** to address skills shortages in specific economic sectors.

In addition to cross-European initiatives, each EU MS has their own **national-level approaches** for assessing future skills and labour force needs. All EU MS carry out some form of skills anticipation utilizing skills assessment, forecasting, foresight or other methods[6]. Therefore, regional initiatives are a supplement, instead of a replacement, for national forecasting initiatives.

Based on EU MS practices, this Methodology assessed the **as-is forecasting approaches** of Eastern partner countries in the following dimensions:

- Data collection and classification approach;
- Digital skills forecasting;
- Regular quantitative ICT labour force forecasting, including as part of general labour force forecast;
- Other methods of skills needs anticipation in the country, such as qualitative assessments, skills surveys or one-off labour market forecasts.

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[6] CEDEFOP (2017). How are skill needs assessed and matched? What is in place in EU countries. Available at: https://skillspanorama.cedefop.europa.eu/en/blog/how-are-skill-needs-assessed-and-matched-what-place-eu-countries

5. Baseline of Eastern Partner Countries

5.1. Institutions Involved in Measurement and Forecasting

This section describes the institutions involved in digital skills data measurement and forecasting. Common ownership and oversight of indicator measurement plays a key role in obtaining and coherently analysing statistical data on a national level. A **central agency**, such as a Central Bureau of Statistics or equivalent institution, should take the leading role on implementing collection and analysis of statistical data ensuring common periodicity, classification, survey format and sample sizes for ease of comparison. Coordination, oversight and strategy also requires **ministry** and/ or **stakeholder partnership**, such as national coalition, ownership. Moreover, identification of key institutions involved in digital skills measurement and forecasting informs recommendations on the split of roles and responsibilities for the implementation of this Methodology.

In most Eastern partner countries statistical data on basic digital skills indicators is collected by the **Central Bureau of Statistics or equivalent institution**. Moreover, **ministries of education and economics or high-tech industries** are involved in data collection in all countries except UA, where the **Ministry of Digital Transformation** is responsible. **Ministries of education and science** collect data on education indicators in all Eastern partner countries. However, in some cases ownership over digital skills measurement can be fragmented. In most countries other actors, for example, other ministries or governmental institutions, non-governmental organisations (NGOs), private companies or international organisations, also collect some digital skills data that enables analysis of a broader set of indicators, but can make coordination, alignment of methodologies and ensuring transparency and availability of data more difficult.

For a detailed overview of institutions involved in the measurement see Annex 4: Institutions Involved in Indicator Collection and Measurement and the corresponding country reports.

5.2. Number of Indicators Measured

Measurement of digital skills indicators in the Eastern partner countries is critical for evaluating the digital skills of the general population as well as persons employed in different sectors of economy as digital skills are rapidly becoming a part of every job role. This section describes the **number of indicators measured** in Eastern partner countries based on the developed benchmark irrespective of the data collection methodology employed. Even if the collected indicators are not directly comparable to EU indicators, they enable countries to adopt evidence-based policy measures to raise the overall digital literacy in turn contributing to the development of the digital economy and society.

Eastern partner countries have **different maturity levels of digital skills measurement** ranging from the measurement of just a few to nearly all benchmarked indicators. On average, ICT in Education and Use of Internet Services indicators are measured the most. The lowest number of measured indicators on average is observed in the Integration of Digital Technology Dimension. Overall, BY, UA and GE measure more than 50% of the benchmarked indicators, while AM and MD measure less than 30%. Moreover, most indicator measurement methodologies are not aligned with EU MS practices. Therefore, the measurement of many benchmarked indicators, while important in assessing national-level skills measurement practices, does not imply easier adoption of EU aligned measurement methodologies.

Table 3. Number of benchmarked indicators measured by country

Dimension	AM	AZ	BY	MD	UA	GE	Total number of indicators included in the benchmark
Use of Internet Services	4	6	6	2	6	6	**6**
Human Capital	0	4	3	0	1	4	**4**
Internet Usage Purpose	2	7	14	0	16	11	**18**
Integration of Digital Technology	1	1	10	2	10	6	**17**

Dimension	AM	AZ	BY	MD	UA	GE	Total number of indicators included in the benchmark
ICT in Education	4	3	4	4	5	3	**6**
ICT in Workforce	4	3	4	0	2	3	**5**
Total	**15**	**24**	**41**	**8**	**40**	**33**	**56**

5.3. Data Collection Methods

This section describes the benchmarked **data collection mechanisms** implemented in each Eastern partner country and their periodicity. If a country has similar data collection mechanisms to those used in EU MS, it will be easier for it to adapt existing methods instead of creating new data collection mechanisms altogether, even if current sampling or survey design approaches differ from EU practice. If a data collection mechanism does not exist at all, the implementation of digital skills measurement according to EU MS methodologies will likely require more time and resources. Alignment of data collection methods would help to ensure comparability and support benchmarking with other countries.

The benchmarked data collection methods have been introduced in all Eastern partner countries with at least annual regularity. However, the implemented surveys and government education data collection methods do not include all benchmarked indicators, nor are their methodologies completely aligned with EU practices.

Several countries have used Eurostat sample surveys in the development of national surveys, for example, the LFS for ICT workforce in MD is based on the Eurostat community survey on ICT usage in households and by individuals. However, all countries need to adjust survey items to match Eurostat methodologies.

Furthermore, UA, AZ and BY have indicated that they base their measurement methodologies on other international frameworks, for example, OECD methodologies. Approval and adaptation of EU and international methodologies in digital skills measurement is a continuous process, so countries are consistently adapting and adding new indicators to their measurement approaches. For example, in GE there are already policies and practices for general digital skills indicator measurement for citizens and enterprises based on EU methodologies and practices, and it would be comparatively easy to adapt their national digital skills measurement to EU MS practices.

Table 4. Data collection methods by country

Country	Individual and/ or household survey	LFS	Enterprise survey	Government education data	Other sources of data
AM	Annual	Annual	Annual	Annual	Yes
AZ	Annual	Annual	Annual	Annual	N/A
BY	Annual	Annual[7]	Annual or bi-annual	Annual	Yes
MD	Annual	Annual	Annual	Annual	Yes
UA	Annual	Annual	Annual	Annual	Yes
GE	Annual	Annual	Annual	Annual	Yes

5.4. Forecasting of Digital Skills and ICT Workforce

In addition to the digital skills measurement baseline, the "**Questionnaire** on the currently used practices for measuring and forecasting national digital skills gaps in the Eastern partner countries" and desk research also covered the baseline for forecasting digital skills (digital skills forecasting, quantitative and qualitative ICT labour

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[7] BY collects ICT workforce data, however it was highly restricted until recently, so the frequency and data collection methods are difficult to assess as much of the data is not publicly available.

force forecasting), as well as alignment with international data collection methods and classification that could support common regional forecasting. Information on future skills needs is key for supporting evidence-based decision making in areas which can affect skills supply[8].

None of the countries have implemented regular national-level digital skills forecasting. However, Eastern partner countries perform quantitative and/ or qualitative labour force forecasting, which can support the analysis of skills gaps based on workforce deficits or surpluses. Only AZ has implemented a regular quantitative labour force forecasting model. Most other countries currently rely on labour force surveys and one-off surveys or research to analyse the future needs for ICT workforce.

Moreover, **qualitative mechanisms** for assessing labour force needs are also employed, for example, by involving sectoral experts in the definition of requirements for the education sector. However, overall skills intelligence and industry involvement in skills and labour force needs definition for education should be strengthened across the region[9].

Table 5. Digital skills forecasting practices by country

Country	Regular digital skills forecasting	Regular quantitative labour force forecasting model	Other methods (qualitative assessment, skills surveys, one-off forecasts) [8]
AM	No	No	Yes
MD	No	No[8]	Yes
AZ	No	Yes	Yes
GE	No	No	Yes
UA	No	No[8]	Yes
BY	No	No	Yes

A common regional methodology for forecasting digital skills or ICT labour force is not in place in Eastern partner countries. Differing data collection mechanisms and classifications, including for education and workforce data, are a barrier to creating a common quantitative approach. Implementation of quantitative labour force forecasting in line with EU practices, such as the CEDEFOP Skills Forecast, will require alignment of data collection methodologies. For example, the CEDEFOP Skills Forecast requires use of Eurostat methodologies for collecting data, including demographic data, national accounts and the Eurostat LFS.

Qualitative mechanisms for joint regional skills needs assessment do not face such barriers and could be established in the shorter term. The Digital Skills Network, an already established regional cooperation mechanism, could be used as a platform for creating a common working group, sectoral council or Alliance to tackle digital skills gaps across Eastern partner countries. The Digital Skills Network serves as platform for sharing best practices and experiences among the six Eastern Partner countries and with the EU, promoting synergies and developing ideas for joint harmonisation projects. However, currently the Network only has working groups dedicated to two areas: digital skills measurement and competence framework development[10].

5.5. Conclusions from Digital Skills Measurement and Forecasting Baseline Analysis

5.5.1. Digital Skills Measurement and Forecasting Baseline in Eastern Partner Countries

- While some Eastern partner countries include digital skills in their **policy objectives and documents**, current digital skills indicator measurement policies differ between countries and often are not detailed enough to reflect specific indicators or methodologies.

- **Institutions involved in indicator collection**:
  - in most Eastern partner countries statistical data on basic digital skills indicators is collected by the Central Bureau of Statistics or equivalent institution;
  - ministries of education and economics or high-tech industries are involved in data collection in all countries except UA, where the Ministry of Digital Transformation is responsible;
  - ministries of education and science collect data on education indicators in all Eastern partner countries;

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[8] CEDEFOP (2019). Crafting skills intelligence. Available here: https://skillspanorama.cedefop.europa.eu/en/blog/crafting-skills-intelligence
[9] For a detailed review of the forecasting of digital skills and ICT workforce in the Eastern partner countries see the corresponding country reports
[10] Both working groups were established within the context of EU4D activities.

- o it is common for some of the benchmarked digital skills indicators to be collected by other actors (other ministries or governmental institutions, NGOs, private companies or international organisations).

- Eastern partner countries collect different numbers of the benchmarked **digital skills indicators**:
  - o UA, BY and GE collect more than 50% of the benchmarked indicators, AZ collects approximately 43%, whereas AM and MD collect less than 30%;
  - o on average, ICT in Education and Internet Usage Purpose indicators are measured the most;
  - o the lowest number of measured indicators on average is observed in the Integration of Digital Technology Dimension;
  - o all countries measure at least one indicator only in three indicator categories: Integration of Digital Technology, ICT in Education and Internet Usage Purpose;
  - o while all countries measure some of the benchmarked indicators, their measurement approaches are generally not aligned with EU MS methodologies.

- The benchmarked **data collection methods** (individual and household survey, LFS, enterprise survey, government education data) have been introduced in all Eastern partner countries. However, they do not include all the benchmarked digital skills indicators, for example:
  - o AM has implemented household and individual and enterprise surveys, but they have a more general scope with very few digital skills indicators covered;
  - o AZ has a national policy and methodology in place for measuring ICT skills by enterprises, however many Integration of Digital Technology Dimension indicators are missing;
  - o MD Central Bureau of Statistics runs annual individual and household surveys, an annual labour force survey and enterprise surveys, however, very few indicators describing digital skills are included.

- **Most digital skills related data are not directly comparable** between the countries due to different data collection methodologies. While most of the countries have adapted some of the benchmarked indicators, national level surveys, sample size and the respondent characteristics are not directly aligned with EU MS practices.

- A common **regional-level methodology for forecasting digital skills or ICT labour force** is not in place in Eastern partner countries. Differing data collection mechanisms and classifications, for example, for workforce data, are a barrier to creating a common quantitative approach.

- None of the countries have implemented regular **national-level digital skills forecasting**. However, Eastern partner countries have quantitative and/ or quantitative **labour force forecasting**, which can support the analysis of skills gaps based on workforce deficits or surpluses:
  - o regular quantitative labour force forecasts are implemented by AZ;
  - o other countries currently rely on labour force surveys and one-off surveys or research to analyse the future needs for ICT workforce;
  - o qualitative methods are employed in all countries, although industry involvement in labour market needs definition for education purposes should be strengthened.

5.5.2. Alignment with EU Digital Competence Frameworks and Eurostat Methodologies

- **A systematic approach to measuring and forecasting digital skills aligned with EU policies and methodologies such as DESI and Eurostat surveys, has not been implemented in Eastern partner countries**.

- Currently some Eastern partner countries have begun implementing **EU digital skills frameworks** in education and employment policies, for example:
  - o UA and BY have begun approving standards for enabling training and self-assessment through a national DigComp Platform;
  - o UA has developed a new state education standard, curricula framework and teacher training programmes based on the European Entrepreneurship Competence Framework (EntreComp) and DigComp, however they have not yet been approved on a governmental level;
  - o in BY discussions have been held on adapting the e-CF for the training and employment of ICT professionals;
  - o digital competence standards have been developed and approved for primary, secondary and high-school students in MD considering the e-CF and other relevant EU practices;

- o Project led by the Polissya Foundation *"Contributing to the formation of the agenda and institutional preconditions for enhancing digital competencies in BY, UA and GE"* (2019) aimed to support the use of e-CF in BY, UA and GE, including by the development of a manual and an implementation roadmap for setting up e-CF.

- While most of the Eastern partner countries collect at least some of the benchmarked digital skills indicators, the **methodology is not directly aligned with Eurostat survey methodologies** and therefore DESI indicator descriptions, however, there are some exceptions:
    - o only AZ notes that they have implemented measurement of some digital skills indicators directly linked to the DESI methodology;
    - o MD, BY and GE collect some indicators derived from the Eurostat Community survey on ICT usage in households and by individuals, however, these indicators mostly cover Internet Usage Purpose and not the Human Capital Dimension;
    - o BY and GE also collect some digital skills indicators derived from the Eurostat Community survey on ICT usage and e-commerce in enterprises.

- Differing **data collection mechanisms and classifications** are a barrier to creating a common quantitative approach for digital skills forecasting in alignment with EU practices, such as the CEDEFOP Skills Forecast.

5.5.3. Plans for Digital Skills Indicator Measurement and Forecasting in Eastern Partner Countries

- **All Eastern partner countries have expressed an interest in aligning their existing digital skills measurement and forecasting methodologies to EU practices**.

- All Eastern partner countries have indicated the intention to **expand measurement of different digital skills indicator categories**: DESI related general digital skills indicators, ICT in Workforce and ICT in Education.

- To successfully implement a common Methodology, **Eastern partner countries indicate a need for**:
    - o policy maker commitment and a clear coordinating authority;
    - o expert engagement and training of stakeholders, including those involved in data collection;
    - o availability of financial and human resources for implementing nationwide surveys.

- **National Coalitions** for digital skills and jobs that currently are only established in AM and UA can serve as a cooperation platform for the coordination of digital skills measurement and forecasting policies, practices and a platform to discuss priorities and remedial actions. Where national coalitions are not in place, the coordinating role should be taken by the responsible ministry (typically, ministry of economics, hi-tech industries or digital transformation).

- **In countries where National Coalitions are set to be established during 2020, the implementation of a common Methodology based on EU MS practices should be included in Coalition Action Plans.**

6. Recommendations

6.1. Key Prerequisites for Successful Implementation of a Common Methodology

For key prerequisites to ensure a successful implementation of the Methodology, see Table 6. Key prerequisites for successful implementation of a common methodology.

Table 6. Key prerequisites for successful implementation of a common methodology

No.	Prerequisite	Description
1.	Uniform data classification and indicator content, and reliability needs to be ensured	Uniform methodology, including classification and interpretation of digital skills indicator questions and items based on Eurostat and DESI methodologies
		Uniform survey content: the questions are either embedded in already existing surveys or as standalone household, individual and enterprise surveys on ICT indicators
		Uniform socio-demographic descriptors of respondents need to be implemented including: • gender, age, education, geographical distribution and employment groups for citizens • sector, size, geographical location for enterprises
		Common classification in accordance with CEDEFOP Skills Forecast methodology, including alignment to: • Eurostat national level data • OECD STAN database • Eurostat LFS
2.	Uniform survey implementation approaches and sampling requirements need to be implemented	Representative and compatible sample units, sampling methods and sample sizes
		Implementation of the surveys can follow one of two paths: • implementation of separate surveys based on Eurostat surveys that is more compatible but requires more resources • addition of digital skills indicator questions to existing surveys and/ or alignment of sampling methods to EU practices which requires less resources
3.	Consistency of digital skills analysis	Comparable outputs, periodicity and timing of digital skills data analysis and forecasting must be ensured to support benchmarking
4.	Training of personnel involved in data collection and analysis	Engagement and training for relevant personnel responsible for data collection, analysis and forecasting needs to be ensured, including on the methodologies of data collection and sampling procedures used for DESI. Moreover, support and methodological guidance during the piloting of measurements aligned with EU methodologies should be provided
5.	Budget allocation for implementing nationwide surveys, data analysis and forecasting	Estimation of required resources per country for data measurement survey implementation and data analysis
		Identification of possible financing sources (for example, state budget, private or international donors, EU or other international organisations)
6.	Institutional arrangements	Institutional arrangements are key to ensuring successful implementation and continued use of a common methodology. Implementation should be coordinated by Central Bureau of Statistics or equivalent institution, National Coalitions (where established) and other National Authorities. If a National Coalition is not established, coordination should be carried out by the responsible ministry (typically, ministries of economics, hi-tech industries or digital transformation)
7.	Review and adaptation of digital skills forecasting measurement and forecasting methodologies	Ongoing review of applied methodologies including keeping them up to date with changes implemented in the EU MS needs to be ensured

6.2. Digital Skills Measurement

Implementation of common digital skills measurement would entail the implementation of the Human Capital, Use of Internet Services and Integration of Digital Technology Dimensions of DESI[11], which includes the following indicators:

- Human Capital Dimension indicators:
  - people with at least basic digital skills (2a1);
  - people above basic digital skills (2a2);
  - advanced skills and development (with separate % of female ICT specialists) (2b1);
  - ICT graduates (2b3);
- Use of Internet Services Dimension:
  - content (3a);
  - activities online (3b);
  - transactions (3c);
- Integration of Digital Technology:
  - business digitization (4a);
  - eCommerce (4b).

The DESI methodological note[12] is publicly available and describes the applied methodologies in detail.

The collection of these indicators requires the implementation of the following data collection methodologies:

- Eurostat survey on ICT usage by individuals and households[13];
- Eurostat LFS[14];
- UOE joint education data collection methodology[15];
- Eurostat ICT survey for enterprises[16].

6.3. A Joint Regional Qualitative and Quantitative Methodology for Labour Market Forecasting

For all Eastern partner countries to benefit from implementing a digital skills or ICT labour force forecasting model, a common regional methodology should be adopted in alignment with recognised EU MS practices. We suggest the implementation of a common regional forecasting methodology entails two integrated approaches:

- **quantitative forecast**: the methodology of CEDEFOP Skills Forecast should be considered as the main point of reference as it is widely used in EU MS and some other countries. Implementation would require two phases:
  - adjustment of existing data collection and classification methods to align with EU MS practices (Eurostat national level data, OECD STAN database and the Eurostat LFS);
  - inclusion of Eastern partner countries in the CEDEFOP Skills Forecast or development of a regional forecast with a methodology aligned with the CEDEFOP forecast to enable benchmarking;
- **regional mechanism for sectoral cooperation on skills** based on EU MS practices in sectoral skills council and Alliance establishment in key areas of the digital economy. The Digital Skills Network i serves as platform for sharing best practices and experiences among the six Eastern partner countries and with the EU, promoting synergies and developing ideas for joint harmonisation projects. However, the Digital Skills Network does not have a dedicated working group for skills forecasting on a regional level. A common mechanism for skills forecasting on a regional level could support the planning and

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[11] EUROPEAN COMMISSION (2020). DESI 2020. Available at: https://ec.europa.eu/digital-single-market/en/desi

[12] EUROPEAN COMMISSION (2018). DESI 2018 Digital Economy and Society Index Methodological note. Available at: https://ec.europa.eu/information_society/newsroom/image/document/2018-20/desi-2018-methodology_E886EDCA-B32A-AEFB-07F5911DE975477B_52297.pdf

[13] Eurostat (2017). ICT usage in households and by individuals (isoc_i). Available at: https://ec.europa.eu/eurostat/cache/metadata/en/isoc_i_esms.htm

[14] Eurostat (2019). EUROPEAN UNION LABOUR FORCE SURVEY (EU LFS). Available at: https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey

[15] Eurostat (2016). UNESCO OECD Eurostat (UOE) joint data collection – methodology. Available at: https://ec.europa.eu/eurostat/statistics-explained/index.php/UNESCO_OECD_Eurostat_(UOE)_joint_data_collection_%E2%80%93_methodology

[16] Eurostat (2020). ICT usage in n enterprises (isoc_e). Available at: https://ec.europa.eu/eurostat/cache/metadata/en/isoc_e_esms.htm

realization of cross-country initiatives to improve digital skills and foster beneficial student and workforce mobility.

7. Annex

7.1. Annex 1: DESI Dimensions and Sub-dimensions

Table 7. DESI Dimensions and Sub-dimensions

Dimensions	Sub-dimensions
1 Connectivity	1a Fixed Broadband
	1b Mobile Broadband
	1c Fast Broadband
	1d Ultrafast Broadband
	1e Broadband Price Index
2 Human Capital	2a Internet user skills
	2b Advanced skills and development
3 Use of Internet Services	3a Internet Use
	3b Activities online
	3c Transactions
4 Integration of Digital Technology	4a Business digitisation
	4b eCommerce
5 Digital Public Services	5a eGovernment
	5b eHealth

7.2. Annex 2: DESI Human Capital, Use of Internet Services and Integration of Digital Technology Dimension Indicator Sources for Digital Skills Measurement

Table 8. DESI Human Capital, use of internet services and Integration of Digital Technology dimension indicator sources

Dimension	Sub-dimension	Indicator	Source
Human Capital	2a Basic skills and usage	2a1 At least basic digital skills	Eurostat - Community survey on ICT usage in households and by individuals
		2a2Above basic digital skills	Eurostat - Community survey on ICT usage in households and by individuals
		2a2 At Least Basic software skills	Eurostat - Community survey on ICT usage in households and by individuals
	2b Advanced skills and development	2b1 ICT Specialists	Eurostat - LFS
		2b2 Female ICT specialists	Eurostat - LFS
		2b3 ICT graduates	Eurostat UOE
Use of internet services	3a Internet use	3a1 People who never used the internet	Eurostat - Community survey on ICT usage in households and by individuals
		3a2 Internet users	Eurostat - Community survey on ICT usage in households and by individuals
	3b Activities online	3b1 News	Eurostat - Community survey on ICT usage in households and by individuals
		3b2 Music, Videos and Games	Eurostat - Community survey on ICT usage in households and by individuals
		3b3 Video on Demand	Eurostat - Community survey on ICT usage in households and by individuals
		3b4 Video Calls	Eurostat - Community survey on ICT usage in households and by individuals
		3b5 Social Networks	Eurostat - Community survey on ICT usage in Households and by individuals
		3b6 Professional social network	Eurostat - Community survey on ICT usage in households and by individuals

Dimension	Sub-dimension	Indicator	Source
		3b7 Doing an online course	Eurostat - Community survey on ICT usage in households and by individuals
		3b8 Online consultations and voting	Eurostat - Community survey on ICT usage in households and by individuals
	3c Transactions	3c1 Banking	Eurostat - Community survey on ICT usage in households and by individuals
		3c2 Shopping	Eurostat - Community survey on ICT usage in households and by individuals
		3c3 Selling online	Eurostat - Community survey on ICT usage in households and by individuals
Integration of Digital Technology	4a Business digitisation	4a1 Electronic Information Sharing	Eurostat - Community survey on ICT usage and eCommerce in enterprises
		4a2 Social Media	Eurostat - Community survey on ICT usage and eCommerce in enterprises
		4a3 Big data	Eurostat - Community survey on ICT usage and eCommerce in enterprises
		4a4 Cloud	Eurostat - Community survey on ICT usage and eCommerce in enterprises
	4b eCommerce	4b1 SMEs Selling Online	Eurostat - Community survey on ICT usage and eCommerce in enterprises
		4b2 eCommerce Turnover	Eurostat - Community survey on ICT usage and eCommerce in enterprises
		4b3 Selling Online Cross-border	Eurostat - Community survey on ICT usage and eCommerce in enterprises

7.3. Annex 3: ICT in Education and Workforce Indicators

Table 9. ICT in Education and Workforce indicators

Dimensions	Sub-dimensions
ICT in Education	Computers used for educational purposes include desktop, laptop, netbook or tablet computer, whether or not connected to the internet
	Schools having a website - own home page or web site available at school
	Students' attitudes towards and self-confidence in using computers
	Students self-confidence in doing ICT tasks and activities
	People with a degree in a science, technology, math or engineering-related subject
	People with a degree in ICT
ICT in Workforce	Persons employed with ICT specialist skills (the definition of the ICT specialists' occupations is based on the new ISCO-08 classification)
	Employed female ICT specialists (based on ISCO-08 classification)
	Enterprises reporting hard-to-fill vacancies during the previous calendar year refer to a range of situations in which enterprises find it difficult to find persons with particular skills (hard-to-fill vacancies due to skills shortage)
	Enterprises where ICT functions are mainly performed by external suppliers
	Enterprise provided training to their personnel to develop/upgrade their ICT skills

7.4. Annex 4: Institutions Involved in Indicator Collection and Measurement[17]

Table 10.Institutions involved in indicator collection and measurement by country

Organisation type	UA	MD	BY	AM	AZ	GE
Central Bureau of Statistics or equivalent institution	Yes	Yes	Yes	Yes	Yes	Yes
Ministry of Economics or Ministry of High-Tech Industries	Yes	Yes	Yes	Yes	Yes	Yes
Ministry of Education	Yes	Yes	Yes	Yes	Yes	Yes
Other ministries (national level)	Yes	No	Yes	Yes	Yes	Yes
Other governmental institutions	Yes	Yes	Yes	Yes	Yes	Yes
Private companies	Yes	No	Yes	Yes	No	Yes
NGOs	Yes	No	Yes	Yes	No	Yes
International organisations	Yes	No	Yes	Yes	No	Yes
Other[18]	Yes	Yes	Yes	Not reported	Not reported	Yes

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[17] "Yes" indicates if an organisation is involved in indicator collection and measurement

[18] Other type of organisations responsible for digital skills indicators measurement in the country, for example, higher education institutions, scientific and technological associations