



European Skills, Competences and Occupations classification Annual Report

2020

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1. Executive summary

This report covers developments in the European Skills, Competences and Occupations classification (ESCO) during 2020 and the work done by the Commission to ensure the continuous improvement of the classification and to monitor its uptake in the labour market and in the world of education and training. The report presents the work done to create and nurture an active community of stakeholders around ESCO. ESCO is used by a variety of actors in the public and private sector in the European Union, but the interest is growing also from outside the EU. The different types of stakeholders are described, with a high light on the use of ESCO within the European Union, EU services, blueprints, EURES and the Member States, and finally international stakeholders. The section dedicated to stakeholders concludes with the explanation of the communication strategy that is used for the outreach with the community of ESCO users. The report also showcases the process of updating the next version of ESCO (version 1.1) that will be released at the end of 2021. Subsequently, it describes the current activities to maintain the classification, with a special focus on Artificial Intelligence (AI) and data science, which is having an increasing role in keeping ESCO up to date with the current labour market. Finally, the report highlights the novelties in the IT ecosystem that include the new portal and the taxonomy management system.

2. Foreword

2020 was a year of change. The green and digital transitions alongside demographic change affected our social market economy model and our societies. The COVID-19 crisis came suddenly and challenged the way we live and work. Millions of European have been subject to home confinement and social distancing measures, experienced reduced mobility and had to adjust their work-life balance to cope with the challenges of home schooling and extraordinary childcare demands.

COVID-19 also implies changes to skills demand, highlighting the importance of digital skills to communicate and work. The pandemic widened the digital divides that already existed between citizens, age groups, regions and urban and rural areas.

Despite the constraints of this unprecedented situation, we proposed a new Skills Agenda with 12 concrete actions to ensure that people have the right skills for jobs. ESCO, the European Classification of Skills, Competences, Qualifications and Occupations, is an element of this strategy. Since 2017, ESCO offers a multilingual, free of charges and easy-to-use vocabulary to identify skills needed across sectors and occupations, match people with jobs and offer them the right training opportunity.

During this challenging year, ESCO further improved its structure and quality by strengthening its multilingual component and by defining a hierarchical structure for skills categories. It expanded its community of stakeholders and its user base, with more public and private organisations implementing ESCO in digital services in Europe and beyond.

We also have been looking at the future. The next version of ESCO will reflect the trends brought by the twin transitions, focusing on digital scientific and green skills and promoting transversal and entrepreneurial skills and skills for life. We are also working to maximise the opportunities offered by AI and big data and on the evolution of ESCO.

ESCO is now managed by the Labour Mobility and International Affairs directorate. This brings together in the same team ESCO and the Public Employment Services at a strategic moment when, when Member States are starting to use ESCO systematically to tag all the job vacancies and applications shared under the EURES network. This will make it easier for millions of European jobseekers and employers to meet, reducing both unemployment and labour shortages, alleviating the impact of the crisis.

I would like to thank all the stakeholders and colleagues who have contributed to taking forward ESCO during this challenging year. I look forward to continuing our common reflection on how to further develop ESCO as a cornerstone of our digital labour market.

By Jordi Curell, Director for Labour Mobility and International Affairs directorate,
DG Employment, Social Affairs and Inclusion European Commission



3. Introduction

Despite the crisis of COVID-19, the operations for the management of the ESCO classification have not been impacted. The shift towards an online working environment has been smooth and the possibility of organising online meetings opened up the space for more collaboration with ESCO stakeholders. This resulted in many more meetings with the project's stakeholders (both from EU and international stakeholders), a deeper reflection on the communication strategy and the future of ESCO, including finalising the work for the version 1.1.

4. ESCO community of stakeholders

ESCO continues to register strong interest from a wide range of users, including from stakeholders outside of the EU. While there might be many organisations using ESCO, the Commission is currently aware of **85 implementers worldwide** that are using ESCO. This group includes private companies, employment services, public institutions, non-profit organisation, job portals and other organisations who see the value of ESCO for their services.

In 2020, the ESCO community continued to expand and the ESCO team met virtually with around 30 stakeholders to discuss their use cases and interest and to provide support with the practical usage of the classification.

The infographic below captures some key numbers related to the growing community of ESCO stakeholders and the communication that happened in 2020:

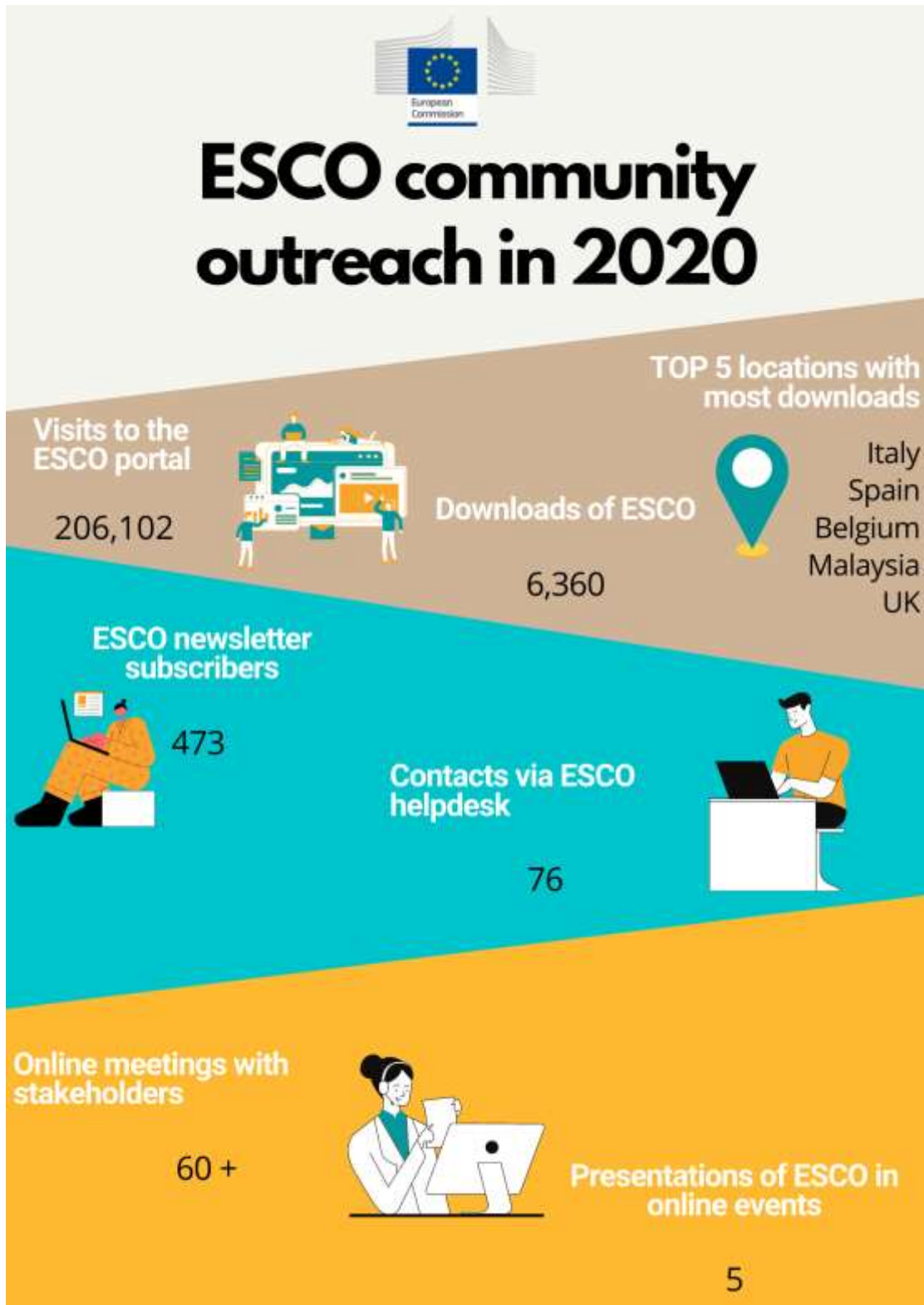


Figure 1. ESCO outreach in 2020

4.1. Take up of ESCO

The Commission is constantly monitoring the implementation of ESCO by different organisations both in Europe and at the international level. In 2020, this was done mainly via video calls with existing and potential implementers. Overall, by end of 2020, we have specifically identified and communicated with **33 ESCO implementers in the public sector** (including public employment services and EU institutions), **52 implementers in the private sector** (including job portals, application developers and other private companies) and **15 EU-funded projects**, sectoral blueprints or other types of projects.

4.1.1. The use of ESCO within the European Union

In the EU, the use of ESCO is growing increasingly. The majority of ESCO stakeholders (implementers) come from Europe and have operations in multiple EU countries and/or languages. Hence, the multilingual aspect of ESCO is highly valued. The graphics below present an overview of the organisations using ESCO for each ESCO use case: job-matching and searching; career learning and development management, statistical research and big data analysis of the labour market.

4.1.1.1. Use of ESCO for job-matching and job-searching

Who is using ESCO for this use case?

The following organisations are using ESCO in their IT systems to deliver job-searching and job-matching solutions:

- [WCC](#)
- [ForeAmmatti](#)
- [House of Skills](#)
- [Milch&Zucker](#)
- [Xlearn](#)
- [AKPA](#)
- [IGB](#)
- [Textkernel](#)
- [Joblift](#)
- [Dit Werkt](#)
- [EURES](#)
- [JobsIreland](#)
- [Jobmarket Finland](#)
- [Monster](#)
- [Iceland's Directorate of labour](#)
- [Symanto](#)
- [Randstad](#)
- [Nalantis](#)
- [Jobspreader](#)
- [Elevate](#)
- [Matchmanao](#)
- [Zeit-Online](#)
- [Almalaurea](#)
- [Actonomy](#)

- [Techwolf](#)
- [JanZZ.technology](#)
- [Almazina](#)
- [My Xtramile](#)



Figure 2. ESCO implementers for job-matching and job-searching

4.1.1.2. Use of ESCO for career learning and management

Who is using ESCO for this use case?

The following organisations are using ESCO in their IT systems to deliver career guidance and learning development management solutions:

- [SkillsBoard](#)
- [Boost.rs](#)
- [Certif-ID](#)
- [Headai](#)
- [Europass](#)
- [ODEM](#)
- [Open Badge Factory](#)
- [Skills Guide by Accenture](#)
- [Caisse de Depots](#)
- [UPSkills](#)
- [Xtoit](#)
- [Orange Cat](#)
- [Skilllab](#)
- [The Adecco Group](#)
- [Cities of Learning](#)
- [Interoperability Academy](#)
- [Kutsekoda – Estonian Qualification Authority](#)
- [Eit – Innoenergy](#)
- [Peers Solutions](#)



Figure 3. ESCO implementers for career learning and development management

4.1.1.3. Use of ESCO for statistics and big data analysis of the labour market

Who is using ESCO for this use case?

The following organisations are using ESCO in their IT systems to undertake statistical and/or big data analysis of the labour market:

- [Deloitte](#)
- [CEDEFOP](#)
- [University of Cambridge](#)
- [European Lung Foundation](#)
- [Burning Glass](#)
- [Intelligence Group](#)
- [Interamerican Development Bank](#)
- [CRISP](#)
- [NESTA](#)
- [Wollybi](#)
- [University of Information Technology and Management of Rzeszow, Poland](#)
- [West University of Timisoara](#)



Figure 4. ESCO implementers for statistics and big data analysis

4.1.2. The use of ESCO by EU services

ESCO is implemented not only by private companies and national public authorities, but also within the Commission services, for a number of purposes. European Commission Directorates-General (DGs), EU agencies and EU-funded projects use ESCO with the aim to:

- Link qualifications to ESCO skills;
- Analyse the European labour market in terms of skills supply and demand;
- Suggest personalised learning content, and
- Identify new occupations and skills in specific economic sectors.

The infographic below gives an overview of the EU Institutions that use ESCO and their individual use cases.



Figure 5. ESCO usage by EU services

4.1.3. ESCO in EURES and status in Member States

ESCO will support the automated skills-based matching of the EURES service platform. EURES is the network of European employment services which aims to provide information, advice and recruitment and placement services for workers and employers.

In 2016 the EURES Regulation¹ aiming to put in place better job search and recruitment services across Europe was adopted. It reinforces the cooperation between Member States and the Commission regarding interoperability, in particular the exchange of CVs and job vacancies via a single coordinated channel and automated matching between job vacancies and CVs.

Article 19 of the EURES Regulation and its Implementing Decisions adopted by the European Commission on 18 July 2018 provide for the use of a European classification of skills, competences and occupations (ESCO) with a view to developing an automated skills-based matching tool through the EURES portal. To enable successful implementation, Member States need to supply the job vacancies and CVs using ESCO codes defining occupations and skills. Member States have until August 2021 to map their national occupational classifications/national skills classifications to ESCO. Alternatively, they can decide to directly adopt ESCO.

By the end of 2020², the state of play was the following:

- **seventeen** Member States were in the process of mapping occupations;
- **five** Member States were in the process of mapping skills;
- **four** Member States were in the process of adopting occupations;
- **four** Member States were in the process of adopting skills.

The distribution of the concerned Member States is explained in the graphic below:

¹ Regulation (EU) 2016/589, OJ L 107, 22.4.2016

² The data that we present stem from requests by Member States to use the mapping platform and by information received via EURES. This means that this list is not exhaustive and there could be Member States who map/adopt without having communicated it to the Commission and thus they are not included in this list.

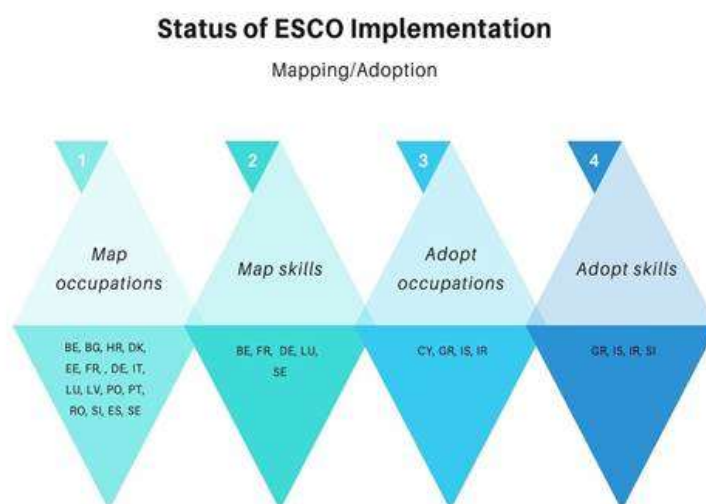


Figure 6. Status of ESCO implementation in the EU Member States³

The approaches used by the Member States to carry out the mapping vary. These could be:

- artificial intelligence tools;
- “human” approach, i.e. experts in the Member States carry out the mapping exercise manually;
- hybrid approach combining approaches one and two.

The Commission supports the Member States in the implementation process in the following forms:

- ESCO mapping platform: the platform is an IT application designed to help Member States map their national classifications to ESCO;
- Mapping manual: a step-by-step guide for mapping NOCs and NSCs to ESCO or replacing them with ESCO;
- Trainings in the form of webinars and workshops;
- Visits - upon request - to the Member States⁴;
- ESCO Helpdesk: a central European contact point to clarify difficult/ambiguous cases composed of a team of experts who reply to enquiries received by the mappers. The ESCO helpdesk is accessible via EMPL-ESCO-SECRETARIAT@ec.europa.eu;
- The Commission launched the call for proposals VP/2019/010 "EURES: support to national classification inventories and innovative national online services for mobile workers". The aim of the call was to financially and technically support Member

³ Romania, although it commenced the mapping exercise in February in 2021, is included in the list because the submission of its request to use the ESCO mapping platform dates in December 2020.

⁴ No country visit was realized in 2020 due to Covid-19.

States to comply with the obligations under Article 19 of Regulation (EU) 2016/568. Eight countries applied to the call⁵.

4.1.4. The use of ESCO in the blueprints for sectoral cooperation on skills

[Blueprint for sectoral cooperation on skills](#) are European multi-stakeholder partnerships developing and implementing strategies to address skills shortages in key sectors of the European economy.

Launched in 2016, the Blueprints bring together businesses, education and training providers, research institutions, sectoral associations and social partners in order to analyse the major trends that are likely to affect jobs and skills needs in each sector, define skills and occupational profiles needed for the future and roll-out related training programs. The [European Skills Agenda](#) further enhances this initiative through its connection with the [Pact for Skills](#).

Since 2018, the Commission has implemented Blueprint alliances in 21 sectors: automotive, maritime technology, tourism, geo-space, TCLF⁶, additive manufacturing, construction, steel, maritime shipping, defence technologies, batteries for electromobility, agriculture⁷, energy intensive industries, microelectronics, energy, blockchain, cultural heritage, cybersecurity, rail transport, software services and social economy.

The connection between ESCO and the Blueprints happens at different levels:

- ESCO is a valuable source of information for analysing the occupational landscape and skills supply in those economic sectors where Blueprints are implemented;
- Project partners are invited to look at the structure of ESCO occupations when creating new occupational profiles, describing a new occupation not only in terms of tasks but also in terms of required skills and knowledge;
- Blueprints represent a valuable source for the continuous improvement of ESCO, and the results of their analysis on skills and occupations trends support the maintenance of the classification. ESCO v.1.1 will include results from the automotive, textile, maritime technology, tourism, geo-space, defence and additive manufacturing Blueprints.

4.1.5. The use of ESCO by international stakeholders

ESCO is being increasingly used outside of Europe as well. The following organisations have shown interest in learning more about ESCO or have already implemented it into their systems.

- The Public Employment service of Albania;
- The Public Employment service of Israel;

⁵ The list of the awarded grants is available at: <https://ec.europa.eu/social/main.jsp?catId=632&langId=en>

⁶ Textile, Leather, Clothing and Footwear

⁷ Bioeconomy, new technologies and innovation in agriculture

- The Public Employment service of Malaysia;
- The Public Employment service of Peru;
- Upskill, a public-private partnership in Chile;
- Credential Engine, USA;
- Harvard Business School, USA;
- Inter-American Development Bank, USA;
- Deloitte, USA;
- Burning Glass, USA.

ESCO's multilingual richness and semantic structure are the key factors that drive interest from these organisations. Moreover, it shows that ESCO can be tailored to the national, regional and local labour market needs and that it can also serve as a benchmark tool for new developments in different labour markets.

4.2. Linking ESCO skills to qualifications

Building on the work⁸ carried out in 2019, in April 2020 the Commission launched a call for expression of interest to participate in the second iteration of the pilot project for linking learning outcomes of qualifications with ESCO skills. The call for expression of interest addressed countries participating in the European Qualifications Framework (EQF) and organisations testing the use of ESCO.

With this pilot initiative, the Commission's goal is to:

- Develop an enhanced matching algorithm based on artificial intelligence to support the linking process in all EU languages.
- Test the suitability of the linking approach for different actors/institutions, different types of qualifications and different publication processes across Member States.
- Test the usability of the ESCO skills hierarchy and introduce rules and matching relations between skills and learning outcomes of qualifications.
- Assess the required effort by awarding bodies/competent authorities to create the links in question.
- Receive feedback on the ESCO skills pillar.

The following countries and organisations answered to the call and participated in the second phase of the pilot as members or as observers:

- 9 EU Member States: Belgium, Czech Republic, France, Italy, Latvia, the Netherlands, Poland, Romania and Slovenia.
- 2 stakeholder organisations: European Trade Union Confederation (ETUC) and European Association of Institutions in Higher Education (EURASHE).

⁸ <https://ec.europa.eu/esco/portal/news/3e8813c5-9e9b-4b3d-85e4-c110f7809879>

- 1 international organisation: the Inter-American Development Bank (IDB).
- 1 EU Agency: the European Training Foundation (ETF).

For the purpose of this pilot, the Commission developed a new version of the linking platform service. The linking platform was developed as an individual IT component with an improved user interface, an administration interface for managing qualifications data and a multilingual algorithm based on machine learning for suggestions relevant skills and knowledge concepts. The linking platform is fully integrated with the ESCO skills and occupation pillars and makes also use of the ESCO API.

The Commission introduced the objectives and structure of the pilot and the concept of the revised linking service platform during the first project webinar on 26 June 2020. Participating countries and organisations were asked to provide structured data of minimum 25 qualifications from different EQF levels and ISCED fields.

The linking activity began in September 2020 and lasted until December 2020. The Commission organised a second pilot workshop on 6 November 2020 to address the written questions on the functioning of the platform and on the methodological aspects of the projects that were submitted by the participants during the first 2 months of the pilot. A final workshop to discuss the results of the pilot will take place on 8 February 2021. The Commission will discuss the results of the pilot with the EQF Advisory Group and the ESCO Member States Working Group (MSWG) and will publish the final report during the course of 2021.

4.3. Survey results from implementers

The Commission conducted a survey addressed to the ESCO implementers, to better understand their view on ESCO, get additional recommendations for v1.1 and assess their availability for the exchange of KPIs for the improvement of ESCO. 26 implementers replied to the survey. The satisfaction level of the implementers is presented in the chart below.

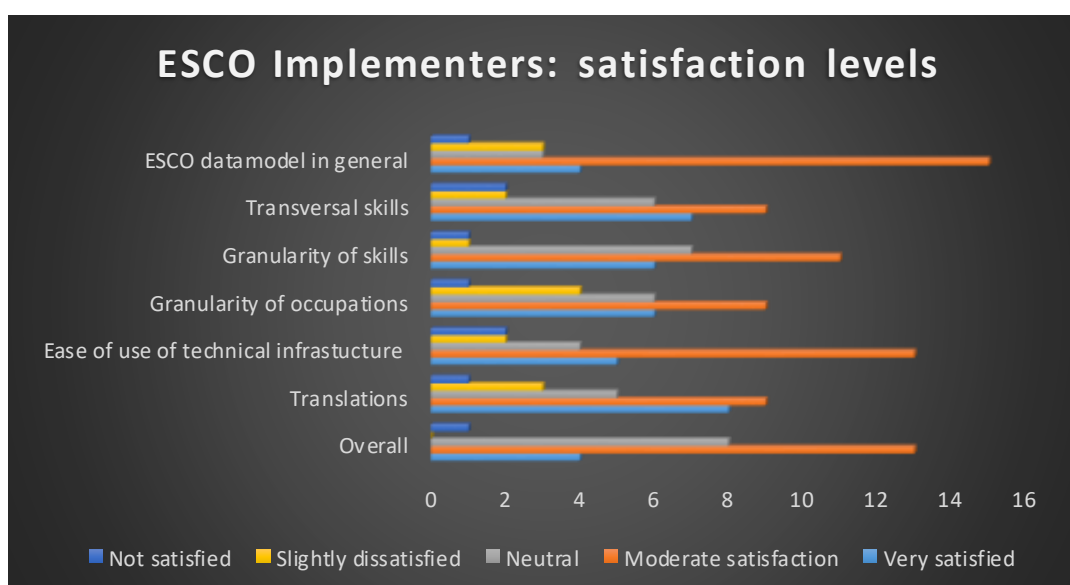


Figure 7. ESCO implementers' survey satisfaction levels with ESCO

Concerning the ESCO data model in general, out of the 26 replies, more than half of the implementers were moderately satisfied with ESCO. 16 implementers combined were very satisfied and moderately satisfied with the transversal skills of ESCO while 2 of them were not satisfied at all. Six implementers were very satisfied with the granularity of the skills and

occupations in ESCO. A bigger number (9 and respectively 11) were only moderately satisfied with the granularity of both pillars.

13 implementers were moderately satisfied with the ease of use of the ESCO technical infrastructure, five were very satisfied while two were slightly dissatisfied and two not satisfied at all. This is often related to the use of the API, where some implementers do not have the knowledge to use it right away. Regarding translations, almost a third of them were moderately happy and another third were satisfied with the translations. In general, half of them were moderately satisfied with ESCO and quite a few had a neutral stand towards the classification.

Additionally, the Commission wanted to learn more about which ESCO characteristic is most valued by implementers (they could multi-select the available options).

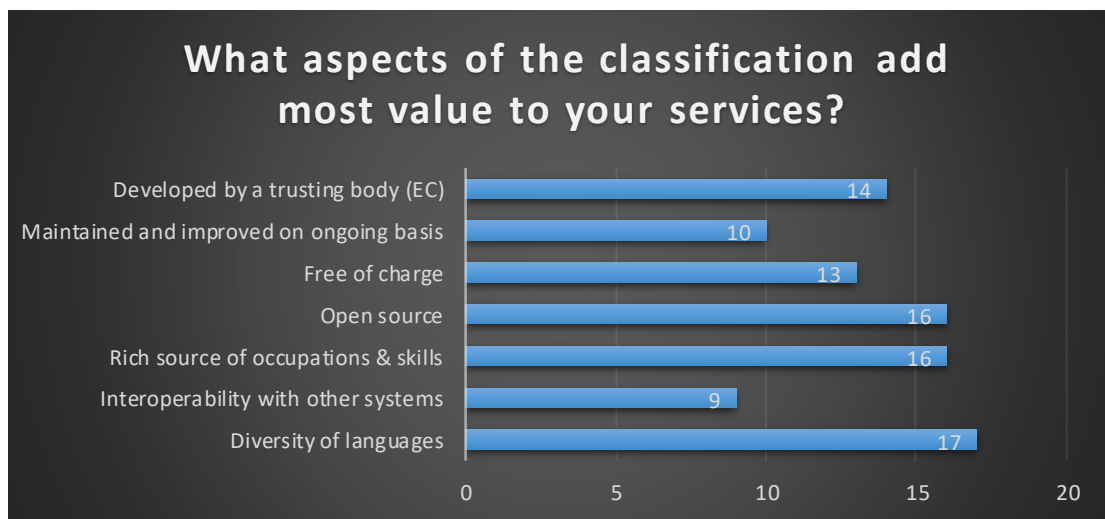


Figure 8. ESCO characteristics valued by implementers

As seen in the chart above, more than half of implementers (17 implementers) highlighted the diversity of languages as the most valuable characteristic of ESCO, followed closely at par by the open source (16 implementers) and the richness of occupations and skills (16 implementers) provided. Also, most of them acknowledged (14 implementers) that they value the fact that it was developed by a trusting authority-an EU institution. And similarly important, a big number of them (13 implementers) considered the fact of ESCO being constantly updated as a significant added-value.

Furthermore, the Commission wanted to learn more about how they assess the value that ESCO brings to their services. The chart below shows the results: 47% of implementers said that ESCO brings value based on the improved quality of their services, 19% said based on the clients' satisfaction with their services and another 19% based on opportunities to expand their business in other countries/languages while 11% based on the increased number of end-users. 4 % were not sure how to distinguish the value ESCO brings to their services.

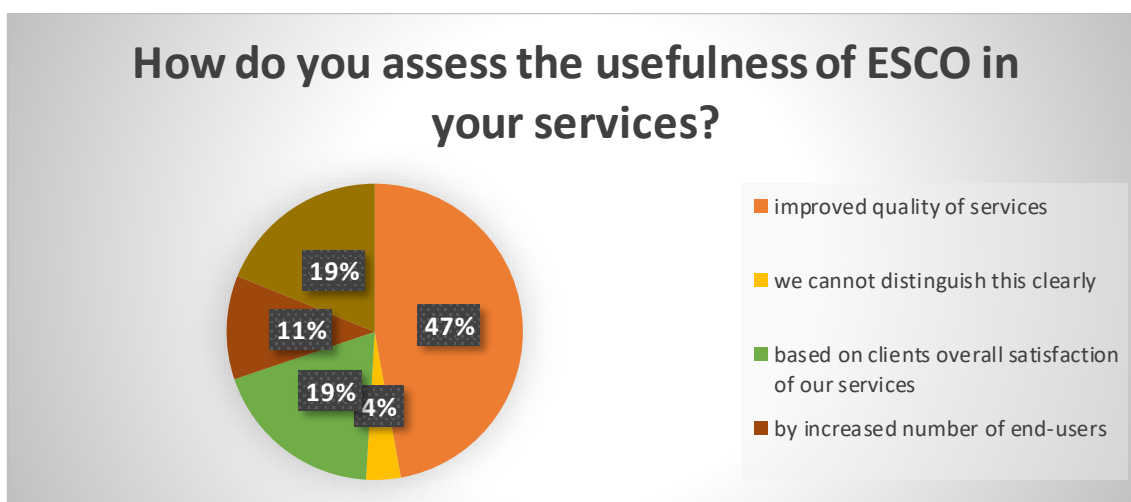


Figure 9. ESCO's value in implementers' services

As for recommendations for ESCO v1.1, the implementers provided the following suggestions:



Figure 10. Recommendations for ESCO v1.1 by ESCO implementers

As it can be noted, there were five main areas that they considered important for the new version of ESCO:

- a faster update cycle, to include more frequently new occupations and emerging skills from the labour market;
- including more soft skills, which are increasingly valued by employers and learners;
- including skills proficiency levels, to distinguish for example between skills that require autonomy and the ones which require supervision;

- linking ESCO with other EU and international occupations and skills competence frameworks (such as O*NET and other EU skills frameworks);
- improving access to the classification, through more user friendly downloading formats and API documentation.

Overall, the survey results were very useful and the Commission will use the input to shape the future of ESCO.

4.4. Communicating about ESCO

Maintaining and engaging an active community of stakeholders is crucial to the development of ESCO. For this reason, communication between the ESCO team and the actors in the field of the labour market, training and education needs to function efficiently and effectively in both directions: the ESCO team provides support and responds to questions regarding the classification while ESCO implementers provide external feedback and suggestions for improvement.

To further improve the way ESCO is communicated externally, the team analysed its stakeholders and consequently created a targeted communication strategy. Moreover, a quarterly newsletter updates its subscribers on every news regarding ESCO and the team is always active to present ESCO during conferences, events and webinars.

4.4.1. ESCO communication strategy

The ESCO team developed an extensive communication strategy to identify, classify and target its stakeholders and to re-organise the work according to the new conditions due to the Covid-19 pandemic.

The strategy outlines the nature and characteristics of ESCO stakeholders. The different stakeholders are grouped based on the role they have in ESCO's governance model and the type of organisation they represent. Further analyses are conducted to map, identify, and target ESCO's stakeholders. Communication goals are defined, grouped per category of stakeholders, and key messages as well as possible engagement levels are detected.

Overall, ESCO makes use of a set of communication tools which help responding to several needs, such as keep stakeholders informed, collect feedback, enhance collaboration, give support, and share ideas and best practices. Among the tools, specific attention is given to social media, for which a more detailed guideline is outlined. In addition, particular effort is addressed to engage and communicate with international classifications, which required a more elaborate analysis.

The strategy also defines the plan for monitoring and evaluating the communication processes. This includes describing the guiding questions and setting target indicators to measure the reach of the communication, its quality and usefulness, and the uptake of ESCO.

4.4.2. ESCO newsletter

During 2020, the ESCO Communication team worked towards the creation of an ESCO newsletter. Thanks to the valuable support of the Commission's Newsroom team, a series of activities have been conducted to ensure a compelling result. The ESCO team designed a modern visual layout and a new structure. The current structure covers the following sections: *News*, *Events*, *ESCO use cases*, *Highlights*, and *Towards v1.1*.



Figure 11. Layout of ESCO newsletter

A distribution list was created, containing a total of 363 recipients. Recipients are different groups of ESCO stakeholders, such as implementers, members of the Maintenance Committee (MAI) and Member States Working Group (MSWG), European associations, and others. During the year, other 91 subscriptions were registered.

The first edition of the newsletter was launched in July 2020, and it registered more than 100 views. The most viewed items concerned news about updates of the ESCO classification and information on the Linking-Learning Outcome pilot project.

Further work conducted during the year included preparatory activities for the second edition of the newsletter (to be launched in January 2021) and the analysis of statistical data automatically generated by the Newsroom portal.

4.4.3. ESCO presentations in online events

One of the main channels for promoting ESCO to a broad range of stakeholders and potential implementers is the participation in events and conferences. Throughout 2020, the Commission presented ESCO in a relatively small number of online conferences and events. The online events are briefly summarised in the table below:

Table 1 – Events where ESCO was presented

Name of the event	Date	Organiser
Interoperability Academy	28/05/2020	EU Commission
Groeningen Declaration Network webinar	05/06/2020	Groeningen Declaration Network
EURES peer-learning activity	22-23/09/2020	EURES
AFEPA meeting	15/10/2020	EU Commission

Fields WP1 meeting	07/10/2020	Fields blueprint
Labour Market Information in Transformation - focus on Big Data, ESCO Skills and EU Graduate Tracking	10/12/2020	European Training Foundation

5. Towards ESCO v1.1

The figure below shows an overview of the ESCO continuous improvement process as defined in 2017.

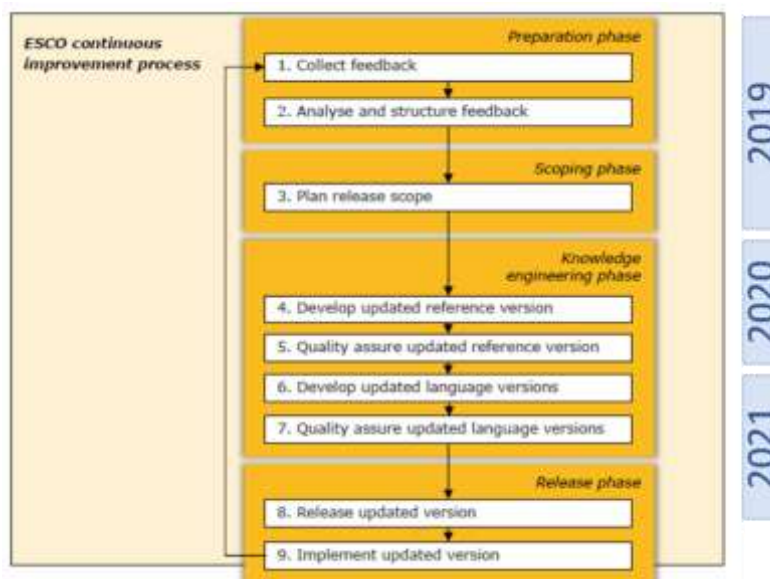


Figure 12. ESCO continuous updating process and timeline

During 2019 and 2020, the Commission analysed the feedback provided by ESCO stakeholders and implementers through different channels: the ESCO community fora, surveys, individual contacts with sectoral stakeholders. Based on the volume of inputs received and on the results of the analysis of this contribution, the update of the ESCO classification was structured in two major blocks:

- the content update exercise and
- the targeted quality review of occupations and skills.

Each block will be explained in the next sections.

5.1. Structuring the content update process

The content update is structured in three work packages: the preparation phase, the research and analysis phase and the implementation phase (creation of new content and changes to existing occupations). The visual below summarises the main steps undertaken.



Figure 13. Process for the ESCO content update

The **preparation phase** took place in May and June 2020 and included three main activities:

1. Labour market analysis

The content update reflected the composition of the labour market around 17 different ecosystems corresponding to the key sectors of the European economy and fully integrated with the priorities set by the Commission in the European Skills Agenda⁹ and in the renewed Industrial Strategy for Europe¹⁰.

To this end, ESCO occupations have been assigned to different economic sectors by using the NACE classification as a reference point. The sectors identified following this mapping have been grouped in 17 ecosystems in order to prioritise those areas that are most affected by the digital and green transitions. The resulting list of ecosystems is reported below.

Table 2 – ESCO ecosystems for content update

Ecosystem	Definition
Tourism	Hotels, short-term accommodation, restaurants and catering, events, theme parks, passenger transport and travel.
Creative and cultural industries	Audio-visual, music, books and press, heritage and libraries, arts and entertainment.
Aerospace and defence	Aeronautics, space and defence manufacturing and space-enabled services and applications.
Textiles	Production of natural and synthetic fibres into yarns and fabrics for the further production of technical textile, carpets, clothes, footwear and leather.
Electronics	Design and manufacturing of electronic components; includes raw materials (semiconductor wafers) and manufacturing tools.
Transport	Production of motor vehicles, ships and trains, accessories, their repair and maintenance, freight transport.

⁹ The New European Skills Agenda: <https://ec.europa.eu/social/main.jsp?catId=1223&langId=en>

¹⁰ European Industrial strategy: https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy_en

Energy-intensive industries	The main industrial users of energy and raw materials, suppliers of intermediate products and innovation to most ecosystems.
Renewable energy	Manufacturers of equipment (e.g. wind turbines, solar modules, electrolysers), key components, biofuel producers, utilities and maintenance and engineering services.
Agri-food	Food production, including agriculture and food processing.
Health	Pharmaceuticals and their ingredients, medical and protective equipment, health services, residential care, HealthTech.
Digital	Covers part of the ICT sector (manufacturing, services and telecommunication industries) and encompasses a number of mature and emerging technologies (e.g. AI, blockchain, quantum, cloud).
Construction	Comprises activities during the whole lifecycle of buildings and infrastructures. Contractors, construction product manufacturers, architects, engineers and others are part of the ecosystem.
Retail	Grocery, non-grocery retail including e-commerce, and relevant wholesale; also suppliers, transportation, logistics, relevant real estate and consumers.
Proximity and social economy	Social Economy: mainly locally anchored economic activity (production, financial or non-financial services) aiming at boosting social impact and inclusive growth in a redistributive manner.
Business and finance	Business administration, legal and accounting, financial services.
Education and science	Educational and scientific activities including research.
Public sector	Includes public policy, law enforcement and security services.

2. Feedback analysis

The input collected during the feedback process has been analysed and distributed across the different ecosystems for further processing. This material ranges from detailed comments to broader analysis of labour market sectors.

3. Prioritisation and assignment

The feedback received and the different sources have been assessed against three key drivers of change in the labour market: **greening of the economy, digitalization, and impact of COVID-19 in the labour market**. This informed the prioritisation of changes to implement in the next version of ESCO and the subsequent research activity and stakeholders' engagement.

The **research and analysis phase** took place in July and August 2020 and included the following activities:

1. Stakeholder engagement

The ESCO team engaged with a variety of stakeholders (i.e. domain experts, NGOs, other Commission services, Blueprint project partners) to discuss in detail the input received and transform the feedback received into ESCO content, where relevant.

2. Desk research

Desk research has been conducted to identify emerging trends in the different ecosystems in terms of new occupations and skills. The research activity was targeted in particular on the greening of the economy and the impact of digital technologies.

3. Gap analysis

The ESCO team analysed the ESCO occupations mapped to each ecosystem to identify existing gaps in the classification, taking into account the feedback received and the results of the desk research.

Based on the work done in the previous phases, the Commission identified three areas of intervention:

- Update of existing ESCO occupations to reflect the skills demanded in the labour market in the context of the twin transition in different ecosystems;
- Creation of new skills and knowledge concepts to reflect those competence areas emerged in the labour market after the publication of ESCO, i.e. blockchain, coding, data protection, big data analysis, green skills;
- Creation of new occupations to reflect emerging trends in the labour market and fill the existing gaps (i.e. public procurement profiles, data protection specialists, etc.).

The **implementation phase** took place between September and December 2020 and included three main activities:

1. Implementing changes

This concerns improvements to occupations and skills already present in the ESCO dataset. Examples are linking existing skills to existing occupations: digital ESCO skills might be now required in a higher number of occupations than those considered in the existing dataset. This is also linked with the findings from the quality review process.

2. Creating new skills

The process for creating new skills and knowledge concepts requires the definition of the different metadata of an ESCO skill or knowledge concept: a description of the concept, alternative labels used in the labour market to refer to that concept, its reusability level and the allocation of the concept to the ESCO skills and knowledge hierarchy.

3. Creating new occupations

The process for creating new occupations involved the definition of the different metadata of an ESCO occupation: a description of the occupation, the list of alternative labels used in the labour market to refer to that occupation, the ISCO group to which the occupation belongs and a list of essential and optional skills using existing ESCO skills and knowledge concepts where possible.

5.2 Validation by domain experts

Validation from domain experts ensured that the desk research and the implementation of the feedback received met labour market trends. More than 40 public and private stakeholders supported the Commission during the implementation phase and contributed to creating the final set of occupations and skills and knowledge concepts which formed the basis for the consultation of the ESCO Maintenance Committee and the ESCO Member States Working Group. Domain experts contributed to the content creation and validated the new occupations and skills proposed by the Commission.

5.3 Quality review of existing concepts

During 2019, the Commission discussed with the ESCO Maintenance Committee about how to address and prioritise the challenges identified during the preparation phase of ESCO version 1.1, such as:

- differences in granularity and level of detail of skills;
- sectoral bias;

- complex language;
- inclusion of the diversity of MS labour markets;
- frequency of updates;
- connection to other frameworks and classifications;
- prioritisation of sectors in view of the next major release.

Addressing quality issues was retained as one of the key challenges for improving the usability of the classification. The Commission decided therefore to conduct a complete review of the occupation and skills pillars that, combined to the feedback received from ESCO implementers, allowed to:

- identify duplicate and/or ambiguous concepts;
- correct typographic errors;
- reduce preferred terms that are too long;
- modify incorrect sentences;
- revise the action verbs used in terms (preferred or non-preferred);
- identify issues in the implementation of skills contextualisation;
- identify skills which are described as tasks or detailed activities;
- identify imbalances in the distribution of skills across occupations;
- adjust mappings of occupations to ISCO;
- address inconsistencies in the hierarchical structure of occupations (broader/narrower relations);
- modify the list of non-preferred terms;
- correct misallocation of skills in the skills hierarchy.

Terminological, conceptual and format guidelines have been evaluated to ensure they provide the necessary guidance to address the quality issues. For future versions of ESCO, the Commission is currently exploring how new technologies could support finding these quality issues or deviations from the guidelines and prevent them from occurring. This will make quality assurance of ESCO more efficient, allowing more resources to improve ESCO in other areas.

5.4 Consultations with ESCO governing bodies

On 15 December 2020, the Commission launched a consultation with the ESCO Maintenance Committee on a draft pre-release version of ESCO v.1.1.

The pre-release included the final draft of the occupations, skills and knowledge concepts produced during the content update as well as a number of changes to existing occupations

resulting from the content update. More in detail, the ESCO MAI was consulted on 86 new occupations, 441 new skills and knowledge and 84 revised occupations and skills.

The consultation will last until 15 January 2021. After review of the MAI, the Commission will analyse and implement the input received and launch a second consultation with the ESCO Member States Working Group from 28 January to 26 February 2021.

5.5 Translations

Following the results of the review of the ESCO Member States Working Group, the Commission will analyse and integrate the feedback received and translate the new content of ESCO v.1.1 into the remaining 26 ESCO languages.

Member States will be consulted on the respective language versions in the second half of 2021.

5.6 Publishing v1.1

After processing the feedback from Member States on the different language versions ESCO version 1.1 will be finalised and published in December 2021.

6. Managing ESCO

6.1 ESCO versioning system (releases)

ESCO is continuously updated to reflect changes in the European labour market and in education and training. These changes are reflected in new versions of the ESCO classification. These are differentiated between minor and major:

- **Minor versions:** contain changes that do not affect the concept level (i.e. no concepts are added, no concepts are removed and the scope of the existing concepts is not changed). Minor releases refer to typos, adding or removing relations between concepts, making minor changes to the labels and the descriptions, etc. and do not require any update of mapping tables;
- **Major versions:** contain changes that affect either the concept level (i.e. concepts are added, concepts are removed and the scope of the existing concepts is changed) and/or the data model.

The first fully-fledged ESCO (major) version was ESCO v1.0. Already before this version (in order to manage the minor versions that would lead to the first major one), a versioning mechanism was put in place to keep track of changes in ESCO and manage its versions. In 2020, the Commission released four ESCO minor versions, i.e. v1.0.5 – v1.0.8 and commenced preparing the next ESCO major version, i.e. v1.2.

This continuous need for versioning is driven by the ESCO users. These are the ESCO team, Commission services and implementers. For each stakeholder category, versioning is important for different reasons.

ESCO implementers

ESCO implementers are required to cite and identify the exact dataset in order to support their business operations. This means they need to be able to accurately indicate exactly which version of the ESCO dataset underpins their results. This becomes particularly

challenging where the data to be cited are dynamic. For this reason, a versioning indicator and history are important. With these elements in place, implementers could plan development independently, i.e. they can use any ESCO version. In case of a new version, they can decide if and when to implement it.

ESCO team

The ESCO team undertakes tasks related to the development, maintenance and update of ESCO. Given the fast pace of labour market changes, updates need to take place regularly. These updates have to be integrated in the overall planning of ESCO. For this reason, future versions of ESCO are required to be developed in order to capture these changes.

Commission services

Various Units of the Commission services as well as European agencies and other authorities (will) make use of ESCO for their own purposes. For instance, ESCO was primarily developed to be used by EURES, CEDEFOP uses ESCO for projects related to skills intelligence, EUROSTAT may in the future use ESCO for statistical purposes. Ensuring that these services have access to the latest but also to previous versions of ESCO would provide flexibility and independency in their operations.

6.2 The ESCO skills hierarchy

Hierarchical ontologies play a key role in organising and structuring concepts. While the ESCO occupations pillar was – upon its creation and still is - based on the ISCO hierarchy, the ESCO skills pillar was not created based on a hierarchy. The ESCO skills pillar was developed as a flat list of 13.485 knowledge and skill concepts.

In 2019, following discussions with the ESCO Member States Working Group and the ESCO Maintenance Committee, the Commission mandated external experts to support the development of a hierarchy for the 13.485 skill and knowledge concepts of ESCO. The skill and knowledge hierarchy would enable users to search and retrieve the ESCO skill and knowledge concepts systematically for a variety of purposes, including:

- Compiling CVs and job vacancies;
- Matching jobseekers with job vacancies;
- Annotating qualifications with ESCO skill and knowledge concepts;
- Mapping national skill and knowledge classifications to ESCO;
- Creating skill (self-)assessment tools;
- Providing targeted career guidance.

The outcome of the experts' work was a single all-embracing hierarchical framework containing several distinct sub-classifications. Each sub-classification is structured according to different principles and targets different types of knowledge and skill/competence concepts.

Table 3 – ESCO skills hierarchy

Concepts	Sub-hierarchies
Knowledge	A structure based on the International Standard Classification of Education (ISCED-F)
Attitudes and values	A structural arrangement laid out in the transversal section of the ESCO skills pillar
Languages	Skills concepts for each language following the structure currently used in the transversal skills section
Skills	A 3-level hierarchy. The first two layers are adapted from the skills grouping of the Canadian Skills and Knowledge glossary and the third layer derives from O*NET.

The ESCO skills pillar is a mono-hierarchy, where each knowledge/skill concept in ESCO is allocated to one knowledge/skill group. To allow the transferability of any given skill between different occupations, the skill groups are designed to be as homogeneous as possible in relation to at least one of the following characteristics:

- tools and equipment used;
- the type of object on which the work is performed;
- the function or outcome of the task or activity.

The Commission organised sessions with stakeholder groups in order to receive feedback on the skills hierarchy. The objective was to ensure that the latter addresses their use cases and to agree on how it can be further improved. After improving the hierarchy based on this feedback, the skills hierarchy:

- was published on the ESCO portal: this allows users to browse through the hierarchy, download it and run queries in the ESCO API;
- became available in the ESCO mapping platform: this facilitates Member States in the mapping of skill and knowledge concepts;
- was shared with ESCO implementers for additional testing and feedback;
- was incorporated in the continuous improvement process of ESCO and
- was integrated into Europass (levels 1 and 2 of the hierarchy).

6.3 Translation of ESCO concepts descriptions

During 2019, the Commission translated ESCO concepts descriptions with the support of the [Translation Centre for the Bodies of the EU](#).

In 2020, the Commission conducted a three-month consultation with the Member States that allowed to collect feedback on the proposed translations and to review the translation of preferred terms. After implementing the feedback received by national authorities, the Commission published the descriptions of ESCO concepts in all ESCO languages with the release of ESCO v.1.0.8.

6.4 The use of AI and data science

Over the last years, many stakeholders in the labour market, education and training sector, including ESCO implementers, have employed a wide variety of technology to analyse, represent and work with labour market data. These techniques are at the intersection of mathematics and computer science and touch several disciplines: statistical data analysis, machine learning, knowledge graphs¹¹, natural language processing and computational linguistics.

Additionally, this emerging artificial intelligence (AI) technology shows great potential to support the continuous improvement of ESCO and to make this process more efficient. In 2020, the Commission started investigating how AI can make a difference in the different use cases, built and trained preliminary language models, and formulated a way forward to create practical AI applications. The next paragraphs summarize the use cases on which the Commission currently focusses.

Support the ESCO continuous improvement process

So far, the Commission has ensured the quality of data by using an expert-driven, human-based approach: appointing groups of experts (for ESCO v1.0), receiving feedback and validating content with sectoral associations and representatives (for ESCO v1.1). This process requires significant investment both in terms of time and resources. Additionally, manual maintenance of ESCO prevents a true real-time inclusion of labour market data, and the large size of the ESCO classification makes it complex to ensure quality and consistency across different skill and occupation groups.

The technology that is being developed, can help spot inconsistencies and quality issues, and can process larger amounts of labour market data faster.

Develop a knowledge graph

‘Searching’ has changed intensively in the past decade, from looking up keywords to browsing ever more connected information as more data is organised and structured continuously. The Commission has the same ambition for ESCO to grow into a connected knowledge graph of data and metadata, to work in concert with other instruments for enhancing interoperability in the labour market and in education and training. The conscious choice to build ESCO on linked open data principles illustrates that this ambition was there already from the beginning.

The ESCO knowledge graph will consist of a collection of interlinked labour market data about occupations, skills, knowledge and qualifications. Such a knowledge graph will put data in context via linking and semantic metadata, hence providing a framework for data integration, unification, analysis, and sharing.

Artificial intelligence can help to make this process of interlinking efficient and therefore feasible.

Support the implementation of ESCO

The implementation of ESCO might be a moderately simple exercise, but it can be more challenging when the classification needs to be mapped to other structured metadata. Since

¹¹ A knowledge graph is a variant of semantic network with added constraints whose scope, structure, characteristics and even uses are not fully realized and in the process of development (<https://towardsdatascience.com/knowledge-graph-bb78055a7884>)

the launch of ESCO, the Commission has committed to discuss with implementers and investigate how to better support their use and implementation of the classification.

Natural language processing technology can help for example job boards to automatically identify skills and occupations from the user's work history. Or it can help Member States to map national classifications to ESCO, etc.

7. The ESCO IT ecosystem

7.1 The Taxonomy management system

The taxonomy management service is used to manage the continuous improvement of the ESCO classification in its reference language, i.e. English. The platform allows creating new skills and occupational profiles and various other features necessary for the content improvement of ESCO. In 2020, an improved version was released which allowed the Commission to prepare the upcoming version of ESCO, i.e. v1.1.

More specifically, functionalities were added to support the versioning strategy of ESCO (see earlier), improve detection and resolution of quality issues, and support consultation of new and updated concepts.

In view of advancements in the field of artificial intelligence that could automate basic knowledge engineering tasks (currently carried out manually on this platform), in 2021 the Commission will further improve the functionalities of the taxonomy management service in order to provide the knowledge engineers with optimal tools for managing and maintaining ESCO.

7.2 New ESCO portal

The Commission is planning to launch a redesigned ESCO portal in May 2021. This redesign will include improvements based on feedback from different ESCO stakeholders.

The redesign has the goal to improve the usability and the information structure for the visitors of the portal, as well as the maintainability and flexibility of the platform for the Commission. In addition, the platform seeks to reach more users by aligning its appearance and Content Management System with the Europass portal.

The new ESCO portal will include an improved homepage, providing an overview of the main sections that can be found in the portal. This allows users to access directly the classification, the web API and the download section. The quick access to sections benefits users that visit the portal regularly, as they can browse the portal with fewer clicks than in the older portal. New users can also find information about ESCO in the homepage, plus a direct link to the section where the primary ESCO information can be found.

The download section will be restructured as well, reducing the number of packages to download. Packages like the ESCO classification have been merged in compressed files to be downloaded at once, making it easier to download all the information that the user needs. Moreover, a working email address is required to download the classification, allowing the Commission to follow up and provide better support.

In the classification section, changes to the classification will be displayed with every concept, giving users the option to browse and compare the classification in different ESCO versions.

Other general improvements of the new ESCO portal are:

- Improve content discovery through search, filtering and sorting actions, by making the search functionality more visible and adding filters to it. Providing access to concepts located in the different sections of the portal;
- Change in the layout of the site to efficiently use the available space, reducing the scrolling and giving improved visual organization;
- Enhance the navigation by avoiding duplicate actions and improving navigational support;
- Implementation of visual hints to help users anticipate the behaviour of interactive elements and explaining the meaning of technical ESCO vocabulary.

Annex 1: ESCO governance bodies

The outbreak of the COVID19 pandemic impacted the organisation and working methods of the ESCO governance bodies.

Except for the 11th ESCO MSWG, all meetings of the ESCO Maintenance Committee and the ESCO Member States Working Group took place online, by using the Webex or Microsoft Teams platforms. This led to the challenge of adapting meeting agendas to a shorter format (generally half-day), while maintaining the possibility of live interaction between members and the organisation of thematic workshops to obtain targeted feedback when requested.

On the other hand, travel restrictions and social distancing limitations offered the opportunity to test the potential of digital technologies to support the work of ESCO governance bodies, bringing an important element of flexibility to the way the Commission seeks the advice of experts. These innovative tools and methods offer therefore a viable alternative to traditional meetings and represent an opportunity for the future.

Meetings of the ESCO Maintenance Committee

The [ESCO Maintenance Committee](#) (MAI) is a technical advisory body, composed of experts in classification systems, labour market terminology and the education and training domain. The MAI provides advice on the continuous technical and conceptual improvement of ESCO, on its technical implementation and on quality control.

Due to the outbreak of coronavirus the 33rd meeting of the ESCO MAI, originally scheduled for 20 March 2020, could not take place. In its place, the Commission decided to consult the MAI in written form on the final version of the ESCO skills hierarchy and invited members to test the hierarchy before its release. The results of the testing were discussed in a dedicated workshop on 30 April 2020, with the participation of representatives from VDAB, House of Skills, SBB, CINOP, the Public Employment Service of Slovenia, WCC, Algebra University, IBE and CEDEFOP.

On 2 October 2020, the Commission organised a [joint session of the ESCO MAI and of the ESCO MSWG](#). The Joint meeting served as an information session for both groups, with the Commission presenting the latest updates on the work for ESCO version 1.1, on the future role of artificial intelligence in ESCO and on transversal skills.

This Joint session prepared the following [34th MAI meeting](#), in which the Commission updated members and collected feedback on the draft content of ESCO version 1.1. It also organised two targeted workshops on potential data sources for the usage of AI in ESCO's maintenance, on the relationship between the ESCO skills hierarchy and the transversal skills hierarchy and presented the upcoming revision of the ESCO portal.

Meetings of the ESCO Member States Working Group

The Member States Working Group on ESCO (ESCO MSWG) is composed of representatives from Member States and the European Economic Area (EEA) countries in the areas of employment and education and training and of representatives of social partners. Its aim is to support the development and the implementation of ESCO.

The ESCO MSWG met three times during 2020.

The 11th MSWG meeting took place in Brussels on 19 February 2020. During the meeting, the Commission introduced the planning of the work for ESCO version 1.1 and presented the results of the first phase of the pilot project for linking qualifications with ESCO skills. Sweden and the Netherlands informed the other members about their experiences and lessons learned in mapping national qualifications to ESCO while representatives from the House of Skills and the Skills4Smart TCLF Industries project presented how they use ESCO.

The 13th MSWG meeting took place following the Joint MAI/MSWG session, on 19 November 2020. During the meeting, the Commission presented to the MSWG the draft new content of ESCO version 1.1 and the upcoming release of the updated ESCO portal, and discussed with members about the updated ESCO's terminology on transversal skills and about data for artificial intelligence in ESCO.

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